STRATEGIC DEFENSE INITIATIVE

Overview

External Affairs Directorate
Strategic Defense Initiative Organization

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STRATEGIC DEFENSE INITIATIVE

Overview

External Affairs Directorate
Strategic Defense Initiative Organization

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OVERVIEW

- Good afternoon (evening) I am _____. I appreciate the opportunity afforded me today to discuss with you the Strategic Defense Initiative.

- I would like to begin by discussing why the nation needs the Strategic Defense Initiative -SDI-by describing the central purpose of SDI and outlining the threat -modernization of the Soviet offensive nuclear ballistic missile arsenal and the proliferation of ballistic missile capabilities to Third World and other nations.

- I will then discuss the scope of the SDI effort, the evolving strategic defense system architectures and theater defense, our compliancy with the ABM treaty, technology spinoffs resulting from SDI research and development, and finally, the cost and cost reduction efforts associated with the SDI program.

OVERVIEW

- Background
- SDI And The Changing World
- National And International SDI Effort
- Evolving Architectures And Theater Defense
- ABM Treaty Compliancy
- Technology Spinoffs
- Cost And Cost Reduction Efforts
- Summary

THE CHALLENGE

- SDI was initiated by President Reagan in 1983.

- On March 23, 1983 President Reagan challenged the nation to pursue the technology to defend against ballistic missiles and to seek deterrence that is based increasingly on defenses, rather than solely on nuclear retaliation. The goal in establishing the SDI was to first shift the basis of nuclear war deterrence from complete reliance on offensive weapons to a balanced offensive-defensive basis, with the eventual elimination of the threat from nuclear ballistic missiles.

- Since then we have been undertaking SDI to examine the possibility of a more stable, secure deterrence for the longer term, based increasingly on defense systems. As we will see in a few moments, the strategic trends of the last twenty years make that effort essential, while scientific and technological advances make it promising.

THE CHALLENGE

"I Call Upon The Scientific Community In Our Country, Those Who Gave Us Nuclear Weapons, To Turn Their Great Talents Now To The Cause Of Mankind And World Peace, To Give Us The Means Of Rendering These Nuclear Weapons Impotent And Obsolete."

President Ronald Reagan
March 23, 1983

PRESIDENTIAL DIRECTION

- Upon its initiation, the program was directed to accomplish three objectives. The Department of Defense was tasked to direct the advances in science and technology to find a way to defend against ballistic missile attack.

- SDI was tasked to provide a hedge against a Soviet breakout of the ABM Treaty. By developing the technologies in the SDI program and bringing them closer to maturity, it was believed that the Soviets would be less inclined to breakout of the ABM Treaty.

- Third, SDI was tasked to provide a hedge against possible new Soviet offensive threats against key elements of our deterrent forces.

PRESIDENTIAL DIRECTION

". . . Research And Development Program Aimed At An Ultimate Goal Of Eliminating The Threat Posed By Nuclear Ballistic Missiles."

". . . Increase The Contribution Of Defensive Systems To Our Security And That Of Our Allies."

"U.S. And Allied Security Remains Indivisible."

"SDI Represents No Change In Our Commitment To Deterring War And Enhancing Stability."

THE SDI PROGRAM IS OPERATING UNDER CHANGED CONDITIONS

- In the 1980's, the prospect was for a non-cooperative transition, therefore the SDI program was designed to deal with the unconstrained Soviet Strategic Weapons and Countermeasures Program as its focal point.

- The focal point of Strategic Defense has changed over the last six years, and most dramatically within the last few months with the Middle Eastern crisis at hand.

THE SDI PROGRAM IS OPERATING UNDER CHANGED CONDITIONS

- In 1980s, Prospect Was For A Non-cooperative Transition
- Therefore, SDI Program Designed To Cope With:
  - Unconstrained Soviet Strategic Weapons
  - Unconstrained Soviet Countermeasures Program
- Planned For Phased Defensive Deployments (Phase I, II, III, . . .) Of Increasing Performance
- Lower Priority On Limited, Unauthorized Or Accidental Attacks On U.S.
- Ballistic Missile Proliferation Low Level Concern

LOOKING AHEAD TO THE 1990's

- The threat of a Soviet invasion of Western Europe has clearly become less ominous over the past year. In response, there has been a major review of defense budget plans.

- However, regardless of improved US-Soviet relations and potential arms control agreements, the Soviet ability to initiate strategic warfare against the US persists.

- Even under optimistic assumptions, we expect the Soviet Union to improve its own strategic forces. The Soviets may reshape their force to fit a START agreement but we expect them to continue modernizing.

  -- It is important to respond and plan against capabilities, not intentions, because intentions can change.

- The Soviet program includes continued construction of four types of ICBMs (SS-18 Mod 5, silo and rail based variants of the SS-24 and the road-mobile SS-25), three types of bombers (Bear H, Blackjack and Backfire), and modern ballistic missile submarines (Delta IV). The Soviets have also upgraded their ABM system around Moscow.

- In addition, ballistic missile capabilities are being rapidly spread among other third world countries.

LOOKING AHEAD TO THE 1990s

What Has Changed?

- Soviet Political And Economic Reforms
- Improved Climate For U.S. / Soviet Relations
- Declining Soviet Defense Spending
- Soviet Conventional Force Reductions / Possible CFE Agreement
- Prospects For START

What Has Not Changed?

- Soviet Strategic Modernization
  - New SS-18 Mod 5s
  - New Mobile SS-24s And SS-25s
  - New Typhoon And Delta IV SSBNs
  - Bear H, Blackjack And Backfire
  - Strategic Air And Ballistic Missile Defenses
- Further Spread Of Ballistic Missile Capabilities
- Opportunity For A Cooperative Transition

RELATIVE USSR / U.S. STRATEGIC TECHNOLOGY

- The Soviet Union today already possesses extensive strategic defenses. For instance, they have the world's only operational Antiballistic Missile (ABM) site, located around Moscow. In addition, for more than a dozen years the USSR has had the world's only operational Antisatellite System. Equally important to these deployed systems is the Soviet Union's longstanding, vigorous strategic defense research program.

- Since the 1960's the Soviet Union has been conducting a substantial research and development program on defenses against ballistic missiles. In a dramatic departure from traditional secretiveness about this program, General Secretary Gorbachev acknowledged its existence in 1987. Soviet research and development on advanced technologies for defenses has been consistently more vigorous than our own.

- Soviet Strategic defense research and systems currently in place include multiple surveillance and warning radars, a ballistic missile defense of Moscow, passive civil defense of key sectors of Soviet society, and extensive air defenses against manned bombers.

RELATIVE USSR / U.S. STRATEGIC TECHNOLOGY

Deployed Systems	Current Status		
	U.S. Superior	U.S. / USSR Equal	USSR Superior
ICBMs		▓▓▓	
SSBNs	▓▓▓		
SLBMs	▓▓▓→		
Bombers	▓▓▓		
SAMs			▓▓▓
Ballistic Missile Defense			▓▓▓
Antisatellite			▓▓▓
Cruise Missile	▓▓▓		

▓ Primary SDI Mission Area

▓→ Denotes Relative Technology Level Is Changing Significantly In The Direction Indicated

▓ Denotes Relative Overall Average Standing For Comparison Of Deployed Technology Levels (Subsystem Specific Technology Levels Not Depicted)

"Soviet Military Power"
U.S. Government Printing Office;
Sept. '90

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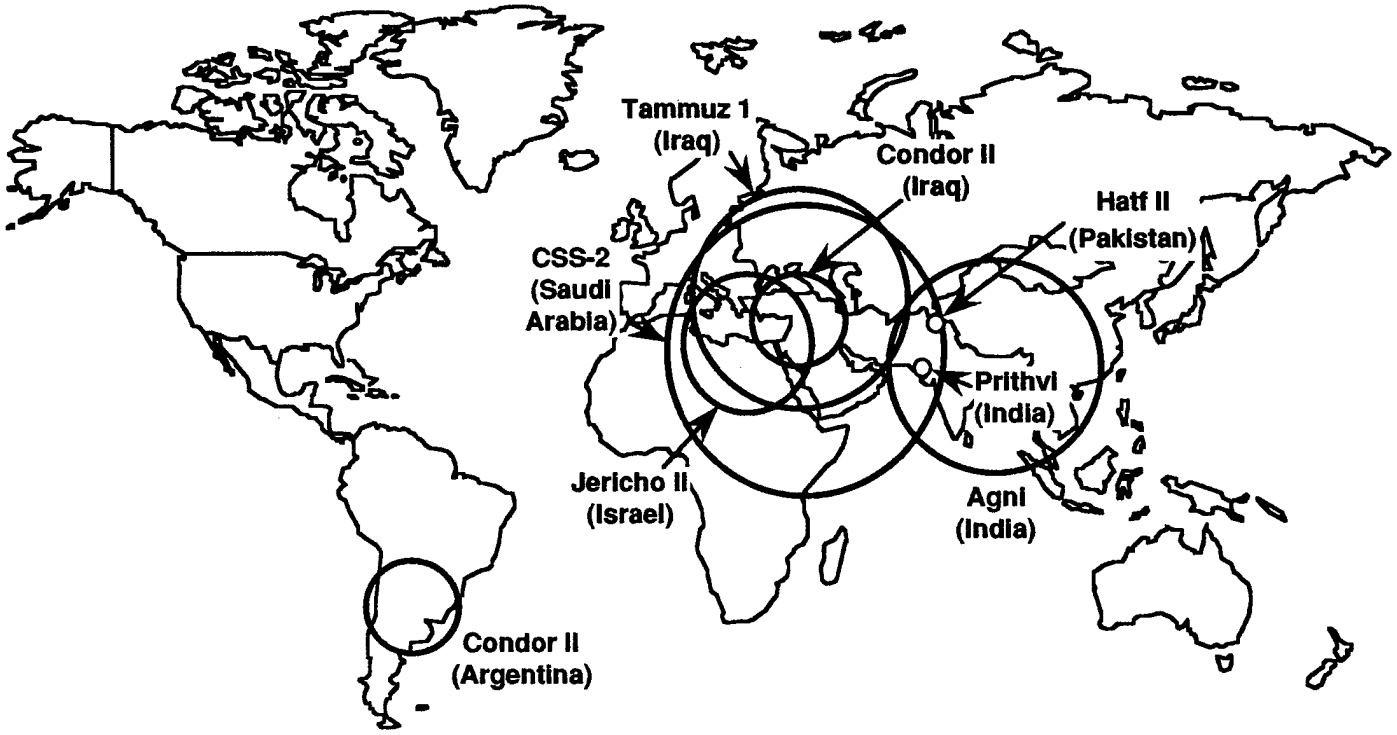
U.S. ALLIES AND FORWARD DEPLOYED FORCES

- In addition, Third World countries are rapidly gaining ICBM capabilities that threaten our allies and our forward deployed forces.

- 15 developing nations are expected to have ballistic missile capability by the year 2000 and these countries are becoming increasing threats.

U.S. ALLIES & FORWARD DEPLOYED FORCES ARE WITHIN RANGE OF EMERGING THREATS



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IN THE 1990's, STRATEGIC DEFENSE MAKES MORE SENSE THAN EVER BEFORE

- President Bush has confirmed his commitment to SDI as a program that will, together with strategic modernization and arms control, compliment our ability to preserve the peace into the 1990s and beyond.

- In recent remarks, Bush stated that "even as we work to reduce arsenals and reduce tensions, we understand the continuing, crucial role of strategic defenses. Beyond their contributions to deterrence, they underlie effective arms control by demonstrating the advantages of cheating. They can also defend us against accidental launches -- or attacks from the many other countries that, regrettably, are acquiring ballistic missile capabilities. In the 1990s, strategic defense makes much more sense than ever before. "

"IN THE 1990s, STRATEGIC DEFENSE MAKES MORE SENSE THAN EVER BEFORE . . ."

- PRESIDENT GEORGE BUSH, FEBRUARY 7, 1990

- **Strategic Defenses Place Deterrence On A More Solid Stable Foundation**
  - **Requirement To Deter Soviet Strategic Force Capability Remains**
  - **Underpin START Reductions**
  - **Basis For Further Offensive Reductions**
- **Strategic Defenses Can Counter Growing Threat Of Third World Ballistic Missile Proliferation**
  - **15 Developing Nations Expected To Have Ballistic Missile Capabilities By The Year 2000**

SDI OBJECTIVES

- The purpose of the Strategic Defense Initiative -- or SDI -- is to provide a more stable basis for deterrence. The SDI is a research and technology development program examining the feasibility of defenses against nuclear armed ballistic missiles.

- The goal of the Strategic Defense Initiative is to increase the contribution of defensive systems to world security while complying with all existing treaty obligations and using non-nuclear defensive systems.

SDI OBJECTIVES

SDI Is A Research And Technology Program, The Objectives Of Which Are To

- **Provide The Basis For A Decision On The Feasibility Of Eliminating The Threat Posed By Ballistic Missiles Of All Ranges**
- **Increase The Contribution Of Defensive Systems To World Security**
- **Conduct The Program In Compliance With All Existing Treaty Obligations**
- **Use Non-nuclear Defensive Systems**

SDIO CHARTER: MISSION

- From here, our discussion will cover the mission of SDIO - to develop and conduct research on technologies for the deployment of defenses - and we will explain what a Strategic Defense Architecture would look like.

- Our discussion will also cover SDIO research participation, technology achievements, our continued focus on treaty compliancy and cost and cost reduction efforts.

SDIO CHARTER: MISSION

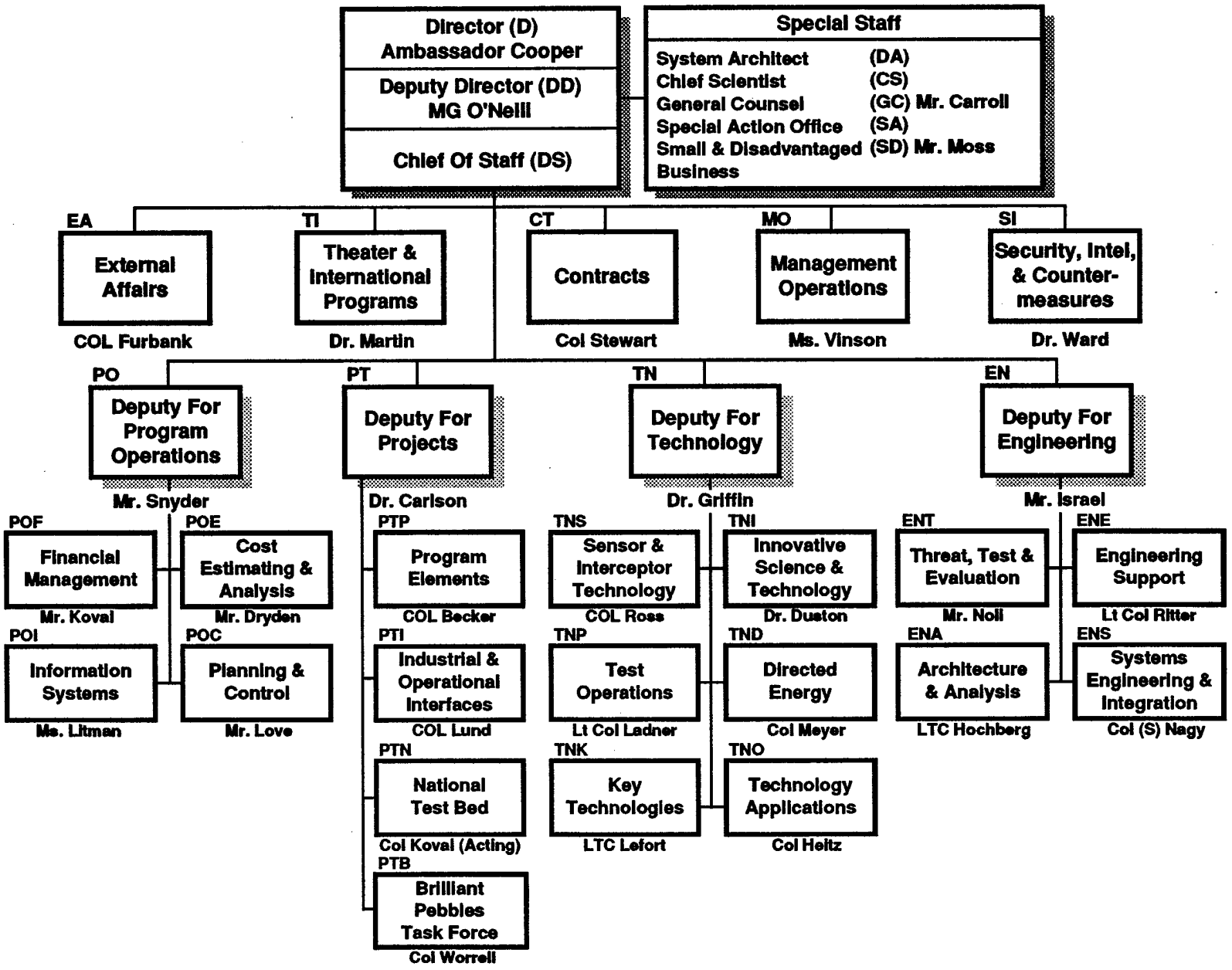
DoDD 5141.5, June 4, 1987

- **SDIO Mission**
  - **Conduct A Vigorous Research Program**
  - **Provide Basis For Informed Decision Regarding The Feasibility Of Eliminating The Threat Posed By Nuclear Ballistic Missiles**
  - **Present Options For Near Term Deployment**

SDIO ORGANIZATION

- This chart illustrates the Strategic Defense Initiative Organization. Each of the technology and systems offices is responsible for managing the research areas of the SDI program.

SDIO ORGANIZATION



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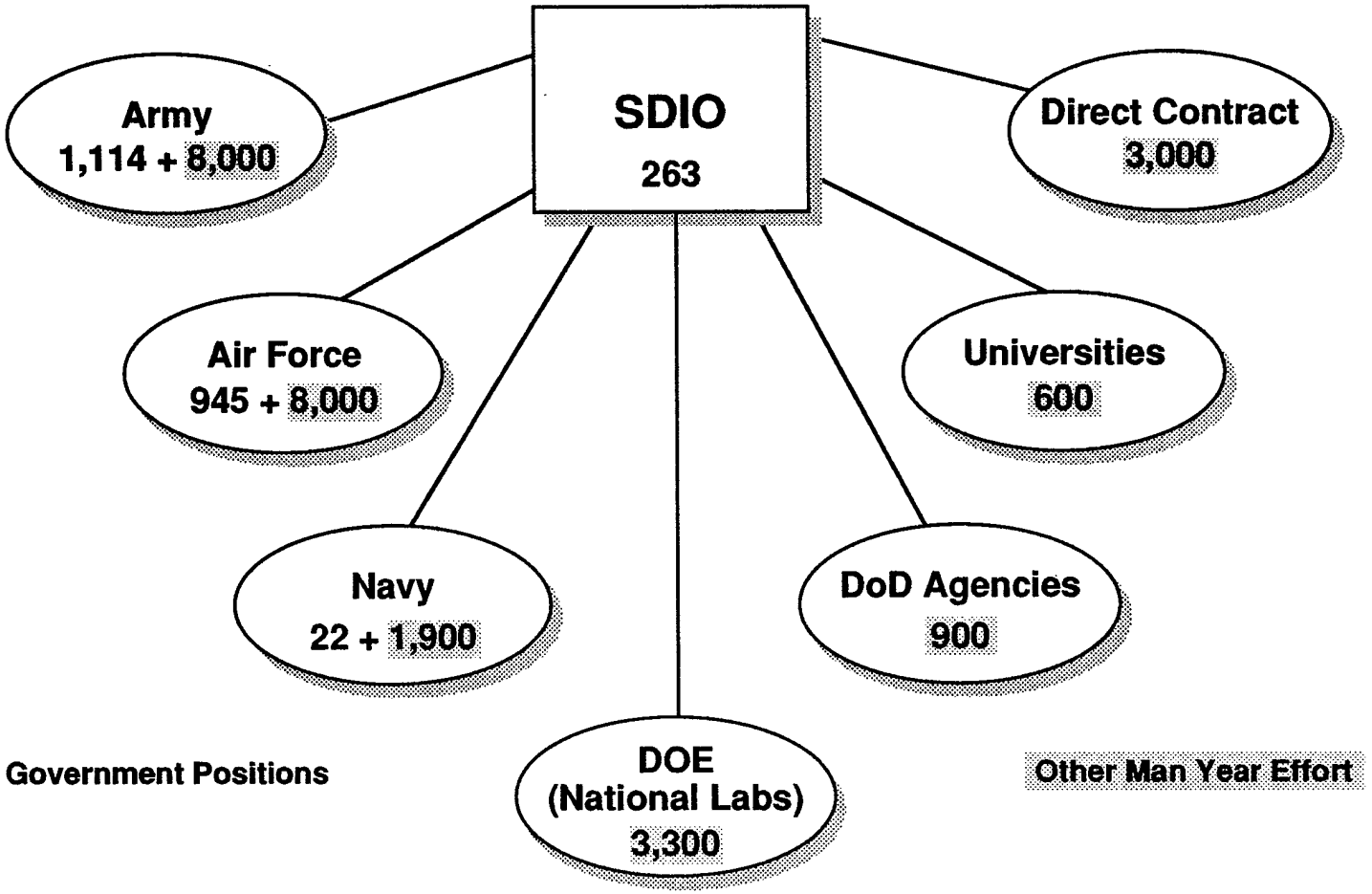
COORDINATED NATIONAL EFFORT - FY90

- As we noted earlier, the SDI Organization is the defense agency tasked with managing the program. However, SDIO is not alone in making the SDI program work. Outside the Department of Defense numerous civilian laboratories, agencies and Universities are involved in SDI research. Inside the DoD, the military departments and several defense agencies participate in the program and are responsible for its technical progress these past few years.

COORDINATED NATIONAL EFFORT – FY90



Approximately 28,000 Man Years

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STATUS OF ALLIED CONTRACTS

- In March 1985 then-Secretary of Defense Caspar Weinberger invited 18 allied governments to participate in the SDI program so that both SDI and Western security as a whole can be strengthened by taking advantage of allied excellence in research areas relevant to SDI.

- This slide shows the overall contracts and dollar value for the ten allied governments participating in the SDI research and development program.

STATUS OF ALLIED CONTRACTS

Country	Number Of Contracts	$ Values (M)
United Kingdom	136	115.32
Germany	39	78.12
Israel	18	222.01 *
Italy	27	16.20
Japan	11	3.83
France	17	16.59
Canada	20	7.39
Belgium	3	0.30
Denmark	1	0.03
The Netherlands	3	19.41 **
Total	275	$479.20

* Includes $47 Million Contribution By Israel

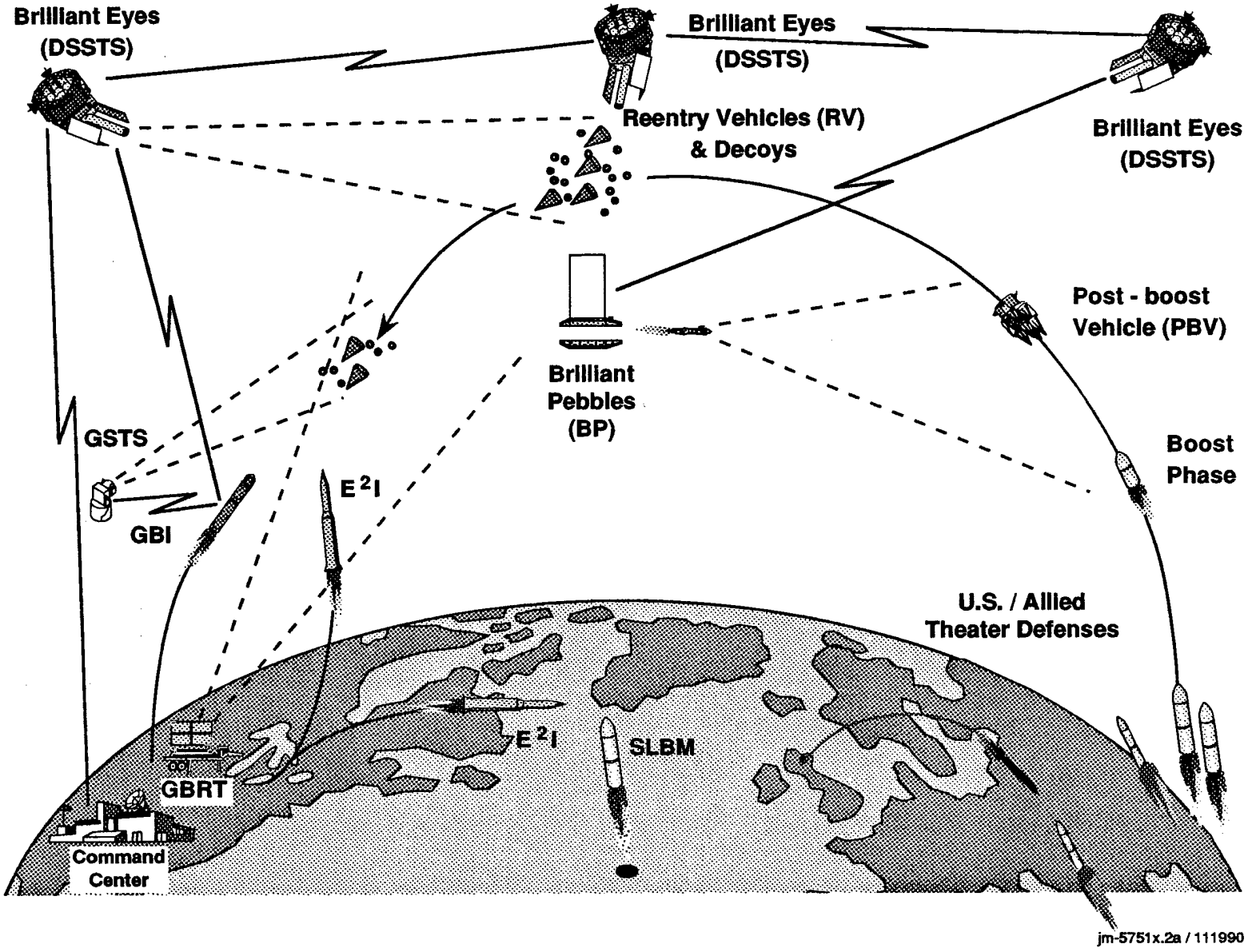
** Includes $7 Million Contribution By The Netherlands

EVOLVING ARCHITECTURES UNDER STUDY

- The Global Protection Against Limited Strikes system is a descendant of the Strategic Defense Initiative Phase I architecture. GPALS is currently being studied as protection against third country and Soviet Ballistic Missile Strikes which may be made up of nuclear, chemical, biological, and / or conventional warheads.

- Layered defenses are those which engage attacking missiles in more than one portion of their trajectories. The significant benefit to layered defenses is that they are highly effective against a variety of attacks and are less vulnerable to possible countermeasures. The SDI program is consistent with this rationale. First, our research is aimed at weapons and sensors for the high payoff, boost / post-boost region where a single hit by a defensive weapon could destroy multiple attacking warheads and their decoys. Second, we are examining ground and space-based weapons and sensors to detect and destroy warheads during their relatively long flights in the midcourse region. Additionally, we will explore ways to engage leakers from the midcourse phase as they reenter the atmosphere in the terminal region, as well as, depressed Submarine Launched Ballistic Missile (SLBM) or Intercontinental Ballistic Missile (ICBM) attacks intended to underfly the midcourse defense system.

EVOLVING ARCHITECTURES UNDER STUDY

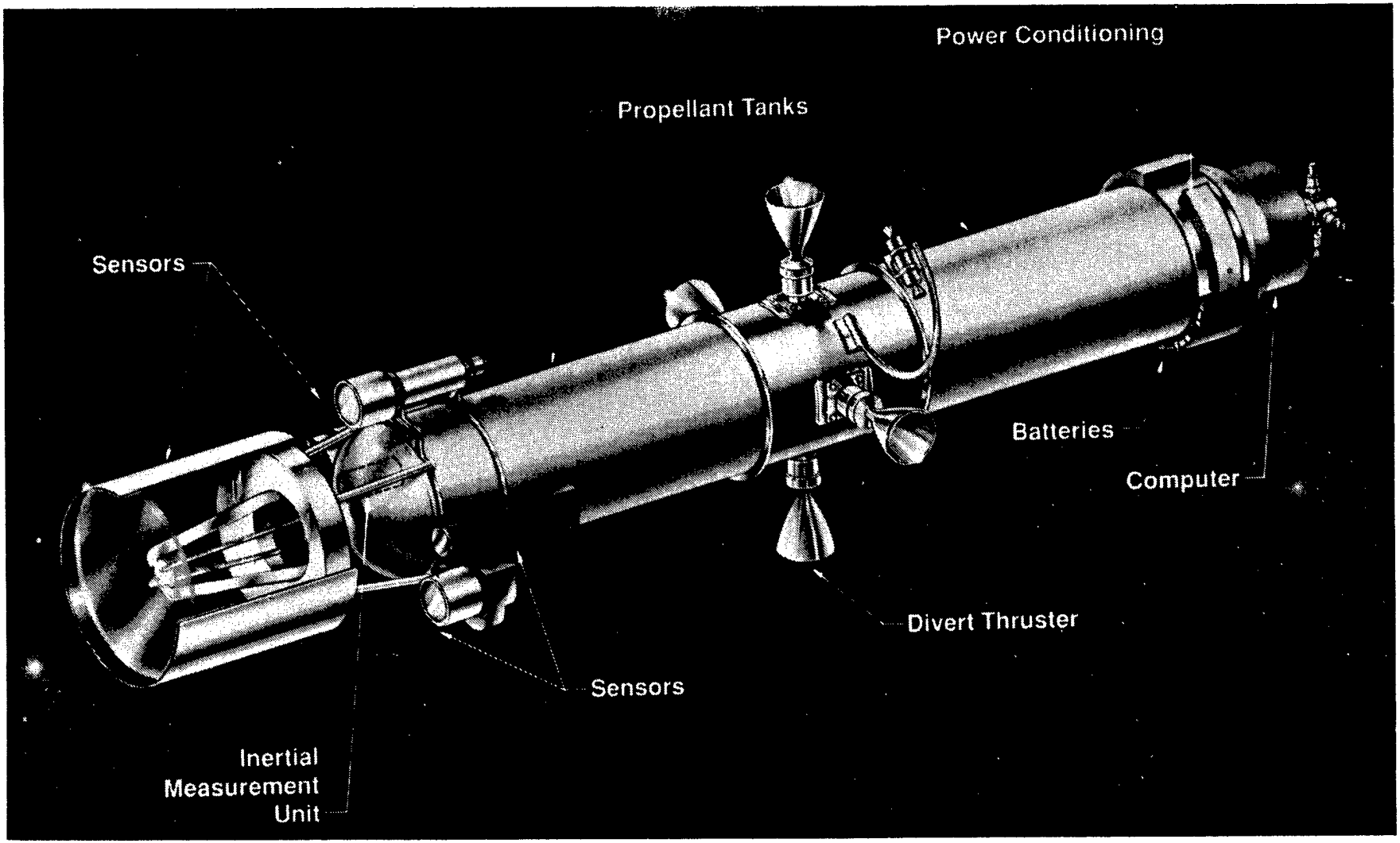


BRILLIANT PEBBLES INTERCEPTOR

- Brilliant Pebbles interceptors are designed to orbit the earth in a constellation of dispersed, individual interceptors, called singlets, each with its own imaging and computing systems, propulsion, station keeping, and communications. Brilliant Pebbles employs kinetic energy as its method of inflicting lethal damage on its target -- it contains no warhead, but rather destroys its target by the force of collision.

- Each Brilliant Pebbles has a star tracker that accurately and continuously determines its position. This is reported back to the command center. Each Pebble also contains its own set of sensors to detect and track ballistic missile launches. Once given a release command, the Brilliant Pebbles would use its divert propulsion system to intercept and destroy these missiles and warheads.

BRILLIANT PEBBLES INTERCEPTOR



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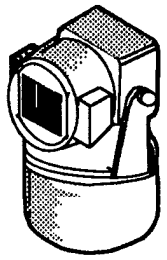
GROUND-BASED SURVEILLANCE AND TRACKING SYSTEM

- The Ground-based Surveillance and Tracking System (GSTS) is designed for the midcourse phase as a fast response, two-stage rocket-launched long wavelength infrared sensor system boosted into suborbital flight.

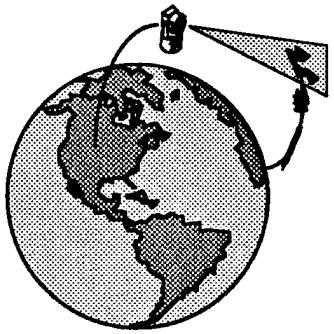
- The GSTS sensor operation is integrated with the ground based radar operation to provide track and discrimination.

GROUND-BASED SURVEILLANCE AND TRACKING SYSTEM

FAS Class Sensor



GSTS



- **Technical Challenges**
  - **Telescope Out Of FOV Rejection And Contamination Control**
  - **Focal Plane Hardness And Producibility**
  - **Track Formation And Discrimination Algorithms**
  - **Data And Signal Processor Hardness, Throughput, And Memory**
  - **Target And Background Phenomenology**
  - **System Integration**

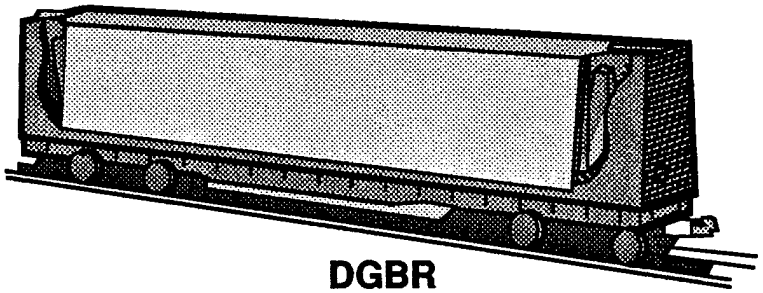
- **Technical Accomplishments**
  - **Midcourse Sensor Study And Similar Studies**
  - **Coordinated GSTS Sensor Design With MSX Test Sensor Design**
  - **Provided Direction For MSX Onboard Signal Data Processor**
  - **Provided Recommendations For Future Nuclear Testing**
  - **Developed Requirements For Beryllium Optics And Advanced Hardened FPA / Signal Processing Development**

GROUND-BASED RADAR

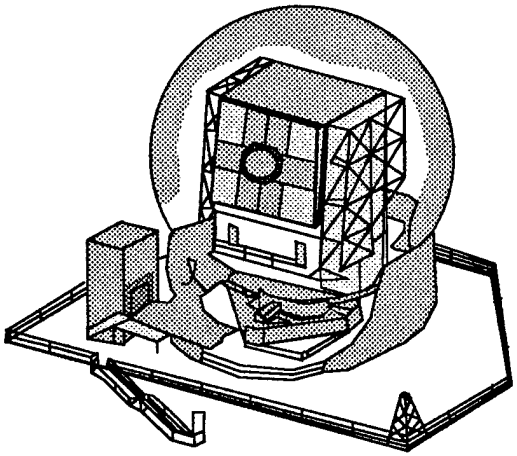
- The objective of the Ground-based Radar program is to advance and demonstrate, in a radar test bed, the techniques required to develop an effective, affordable, and supportable ground-based radar for midcourse and high endoatmospheric Strategic Missile Defense.

- The experiment prototype is a single-faced/dual field of view, fixed, X-band phased array radar, and forms the basis for growth of an operational system, and provides for functional test of critical GBR-D radar functions.

GROUND-BASED RADAR



DGBR
(Deployable)



GBR-X
(Experimental)

- Technical Challenges
  - Real Time Discrimination Of RVs From Penaids
  - Radar And Signal Processing Performance
  - Survivability
  - Electronic Countermeasures / Electronic Counter Countermeasures Performance
  - Mobility / Hardness

- Technical Accomplishments
  - Completed GBR - X Systems Design Review
  - Continuing Technology Progress In Discrimination
  - Algorithm Development
  - Continuing Technology Support For Advanced Waveform Signal Generator
  - Initiated Fabrication And Delivered First 35 Electronic Phase Shifters
  - Initiated Fabrication Of Pilot Antenna Array

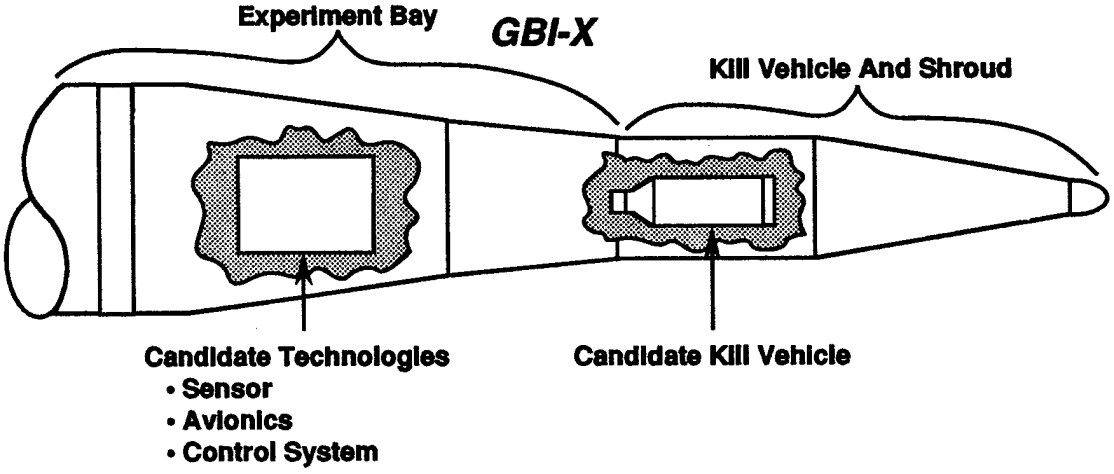
GROUND-BASED INTERCEPTOR EXPERIMENT (GBI-X)

- The mission of the Ground-based interceptor is to intercept ICBM and SLBM RVs that have survived boost phase intercept while in the midcourse phase of their trajectory.

- The Ground-based Interceptor is intended as midcourse exoatmospheric defense for the Strategic Defense System.

- The interceptor is required to operate effectively in the postulated countermeasure and nuclear environments with a probability of kill which will provide cost effective defense.

GROUND-BASED INTERCEPTOR EXPERIMENT (GBI-X)



Objectives

- Demonstrate And Validate Pre-prototype Ground-based Exoatmospheric KVs
  - Identify And Select New Interceptor Technologies, Components, And Concepts
  - Test Via Simulation, HWIL, Hover Tests, And Flight Test Experiments
- Establish / Maintain GBI Baseline Design
- MS II To Support Informed Presidental Decision

Technical Issues

- Discrimination
  - Acquisition Range
  - Target Imaging / Signature
  - On-board Discrimination
- NNK Lethality
  - Impulse / Energy Density Over Lethal Area
  - Response To Target Disguise Countermeasures
- Operation In A Nuclear Environment
  - Nuclear Effects Mitigation
  - Component Hardness
- Cost
  - Affordability
  - Producibility
  - Supportability

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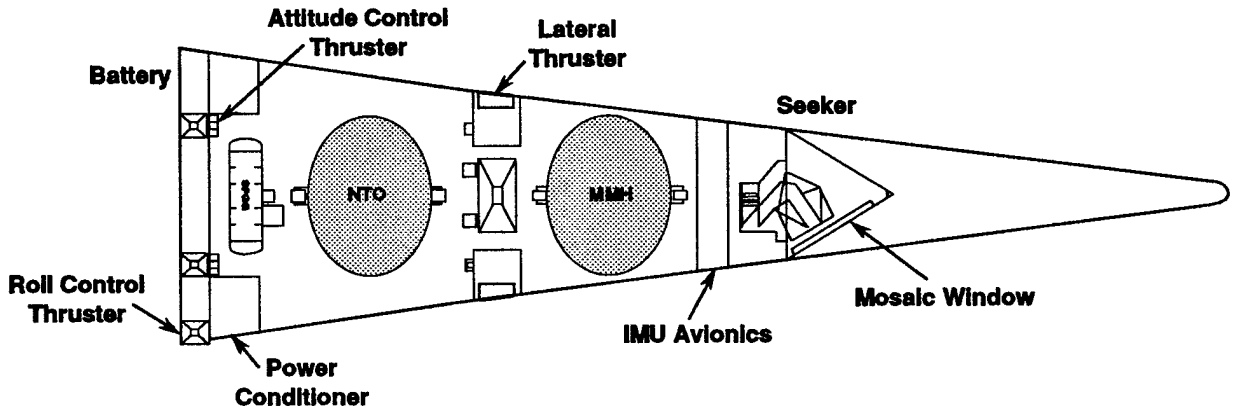
HIGH ENDO/EXOATMOSPHERIC CONCEPT

- The High Endo/Exoatmospheric Concept is an evolution of the established HEDI (or High Endoatmospheric Defense Interceptor) Concept. The evolution to the Endo/Exoatmospheric Concept is a result of expanding the existing design criteria to entail a Low Exoatmospheric arena.

- The Endo/Exoatmospheric Concept remains focussed on the interception of ICBMs and SLBMs in the Terminal Layer.

HIGH ENDO / EXOATMOSPHERIC CONCEPT

High Endo / Exoatmospheric Concept



Characteristics

- Air Vehicle
  - High Velocity-at-burnout
  - Large Footprint
  - Large Divert Capability
- Kill Vehicle
  - Five Times Smaller
  - Hit To Kill
- Seeker
  - Multicolor
  - Target Discrimination

Mission

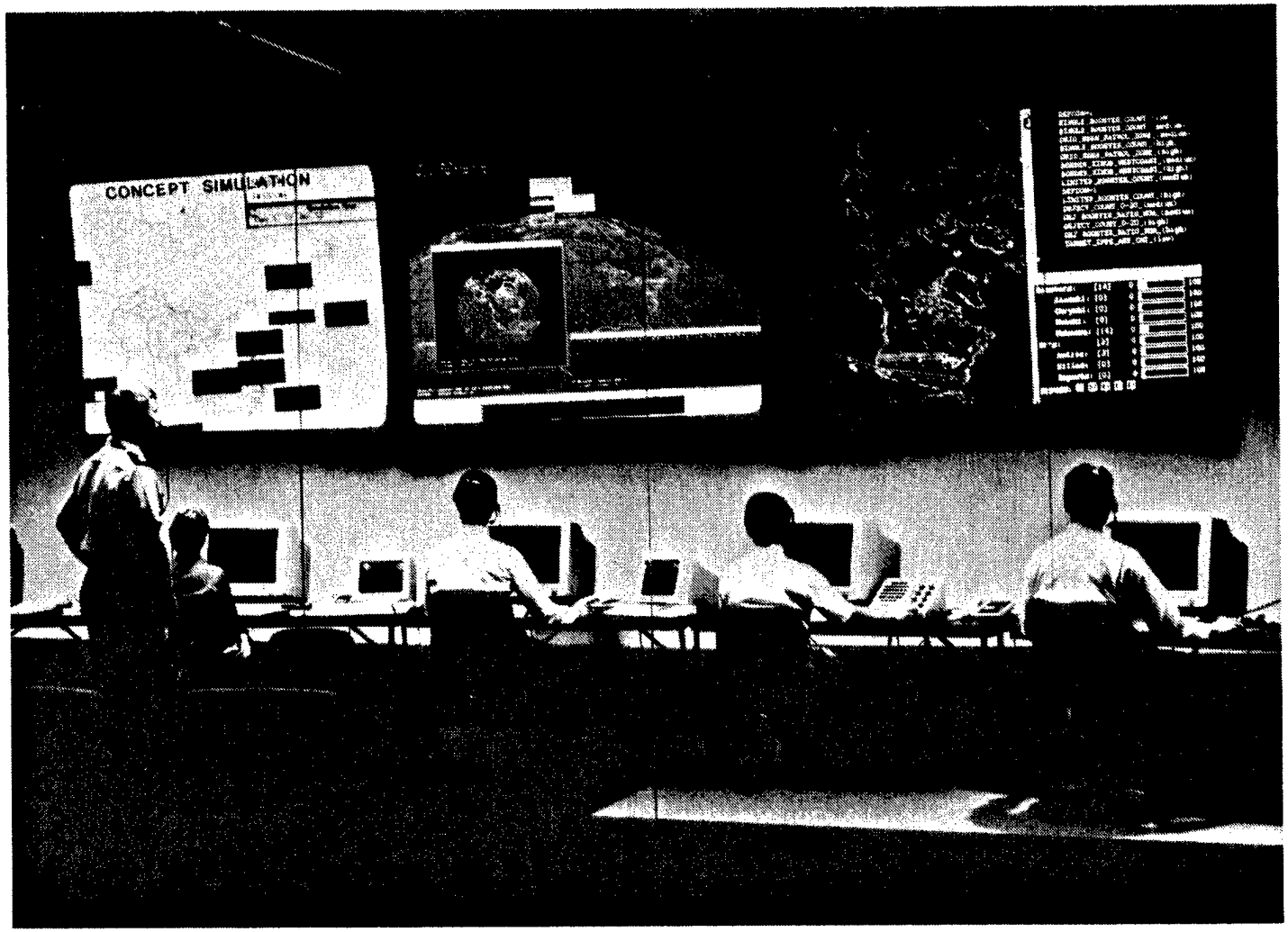
- Terminal Layer, Endoatmospheric Defense (Design Capable To Expand To Low Exo Role)
- Intercept ICBMs And SLBMs
- Evolution Of HEDI Concept

COMMAND CENTER SIMULATION TEST

- The Command Center element of the SDS is the communication center for all components within the Strategic Defense System. It's primary mission is to develop and demonstrate the communication and network control technology necessary to ensure effective, efficient and timely transmission of data from origination sources to the required destinations for processing. Development of advanced communication technology concepts for survivable ground-air/space links is also a main function of this element.

- Command Center requirements include:
  - Maintaining positive control over all SDS elements
  - Collecting and presenting threat data in real-time to support the prompt human decisions necessary to achieve the boost-phase mission requirements
  - Providing inter-element integration and communications
  - Completing sensor and battle management execution functions

COMMAND CENTER SIMULATION TEST



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SDI AND THEATER MISSILE DEFENSE

- In 1985 President Reagan issued guidance which effectively expanded the SDI's research to include theater defense, which would be capable of defending the U.S. and our allies from ballistic missiles of all ranges.

- The challenges of a Theater Ballistic Missile Defense are significantly different from a defense against long-range intercontinental ballistic missiles. Some of the key issues are:

  - Short Booster burn times
  - Low Apogees
  - Short Threat times of flight
  - Combined arms environment
  - Multiple Warhead Types
  - Combined Operations

- The mentioned characteristics heighten the challenges of theater missile defense due to the missiles difficulty to detect and track at short - range and the minimal time a defense can react and intercept the theater missiles.

SDI AND THEATER MISSILE DEFENSE

Presidential Guidance — June 1985

". . . Organized Research Program That Is Aggressively Seeking Cost Effective Approaches For Defending The United States And Our Allies Against The Threat Of Nuclear And Conventionally Armed Ballistic Missiles Of All Ranges."

Secretary Of Defense Guidance

"Explore . . . Specific Ways In Which U.S. Led SDI Research Can Assist The NATO Extended Air Defense Effort . . ."

Deputy Secretary Of Defense Guidance

"With Regard To DoD Programs Relating To Missile Defense . . . That The SDIO Continue To Conduct Research Into Defense Against Missiles Of All Ranges That Threaten The United States And Our Allies"

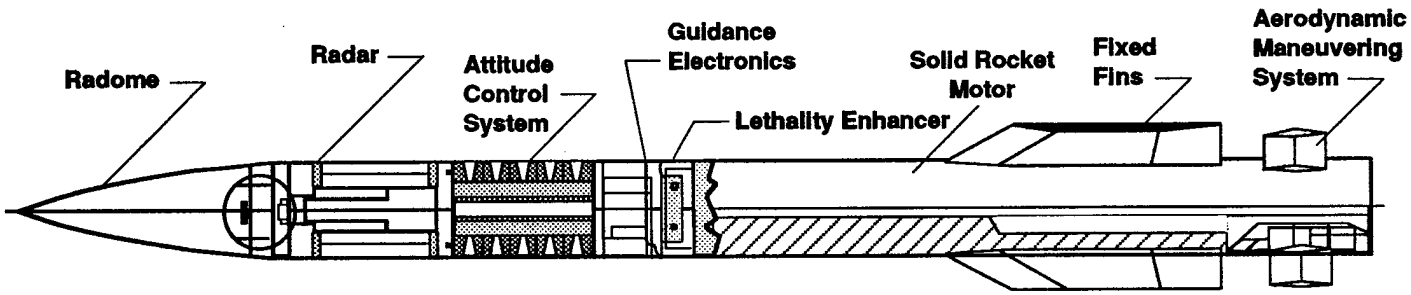
EXTENDED RANGE INTERCEPTOR (ERINT-1)

- The Extended Range Intercept Technology Program is an experiment to validate a concept for a missile that would be a fire-and-forget (updatable), single stage, nonseparating, solid rocket interceptor.

- The solid rocket interceptor will possess inertial midcourse guidance and active RF homing guidance capable of destroying Tactical Ballistic Missiles in the atmosphere.

- The system will provide a high probability hit-to-kill intercept in heavy rain and in an adverse electronic countermeasure environment.

EXTENDED RANGE INTERCEPTOR (ERINT-1)



- **ERINT-1 Will Demonstrate The Hit-to-Kill Capability Of A Small, Low Endoatmospheric Interceptor Concept**
- **ERINT-1 Will Demonstrate The Integration Of A Number Of Unique Technologies, Including An On-board Active Seeker, Composite Rocket Motor Casings, And A Combination Of Aerodynamic And Impulsive Control To Achieve Hit-to-Kill Accuracy**
- **Achievement Of Program Objectives Will Be Measured In A Series Of 8 Flight Tests**

THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)

- The Theater High Altitude Area Defense (THAAD) program will develop and test a high endoatmospheric area defense interceptor

- The THAAD missile will be designed as a wide area defense overlay to planned theater asset defense systems providing high altitude area defense against Tactical Ballistic Missiles in the 2000 and beyond timeframe.

THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)

Description

- **Program Consists Of 12 Month Concept Definition Phase, Followed By 54 Month Dem / Val Phase**
- **Designed To Overlay Planned Theater Asset Defense Systems To Counter The Projected Threat In The Year 2005 And Beyond**
- **Designed To Be Compatible With Existing And Planned Air Defense Hardware**
- **Will Take Maximum Advantage Of SDI Technology Programs**

ARROW KILL VEHICLE

- The Arrow missile program is a cooperative effort with the government of Israel and the U.S., focusing on the development of technological capabilities to enhance U.S. and Allied Forces abilities to counter short range missile threats.

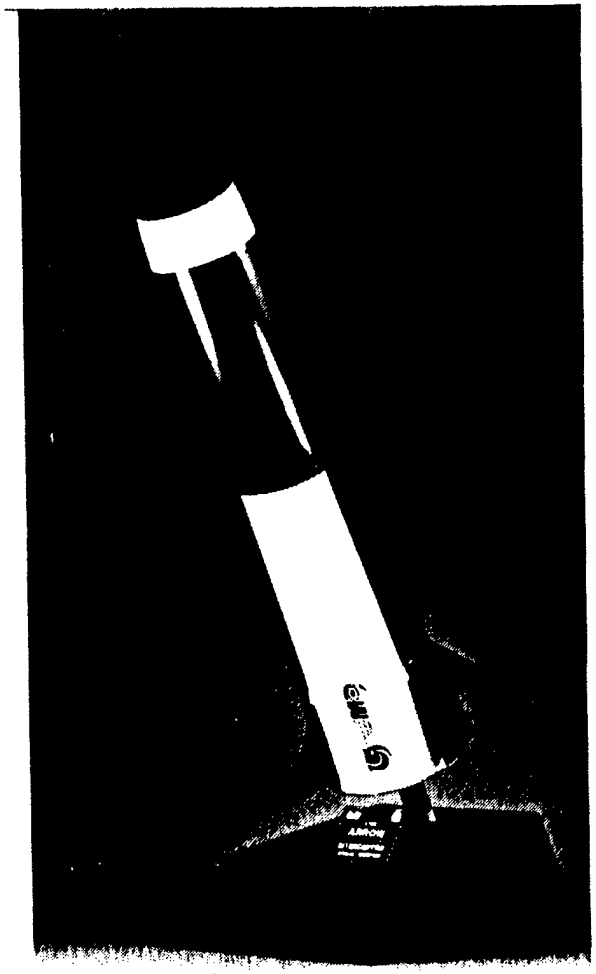
- The primary part of this effort the U.S. government is undertaking is an experiment to demonstrate the Israeli Arrow Missile capability to intercept a surrogate Tactical Ballistic Missile.

- Arrow is designed to work in a Middle Eastern environment, primarily against non-nuclear threats.

- One Propulsion and Control Test flight as well as three interception flight tests will be conducted in the course of this demonstration experiment.

ARROW KILL VEHICLE

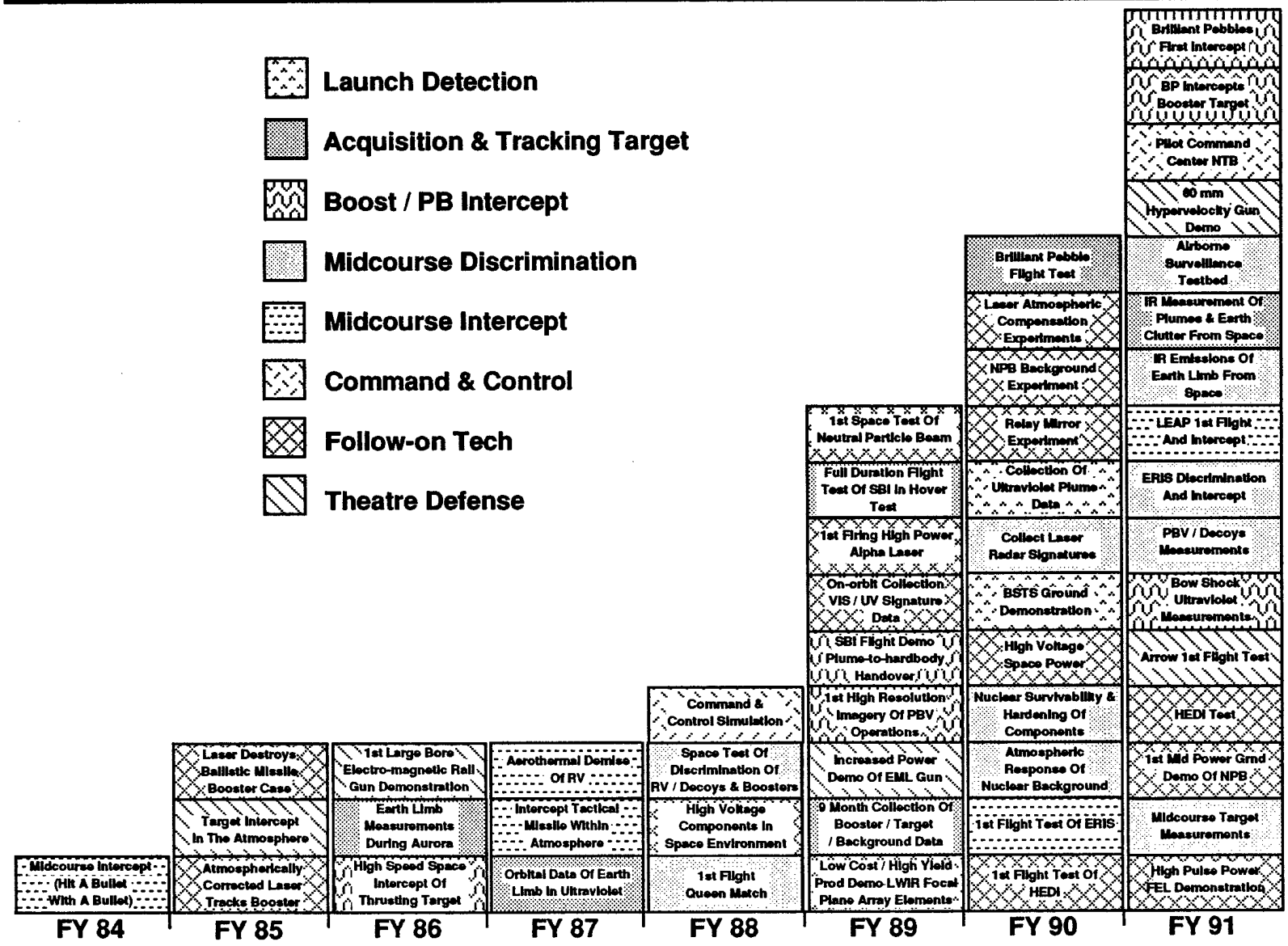
- COOPERATIVE PROGRAM WITH ISRAEL TO DEMONSTRATE ARROW'S CAPABILITY TO INTERCEPT A TACTICAL BALLISTIC MISSILE
- THREE-YEAR FIRM-FIXED-PRICE CONTRACT SIGNED WITH ISRAELI AIRCRAFT INDUSTRIES (IAI) IN AUGUST 1988
- PROGRAM CURRENTLY AHEAD OF SCHEDULE



MAJOR TECHNICAL ACCOMPLISHMENTS

- The SDI program is in its seventh full year of research to determine the feasibility of effective defenses against ballistic missiles, and we continue to make excellent progress across a broad range of technologies. During FY 1990 we conducted a record number of major experiments and tests crucial to program success. The growing number of tests and experiments demonstrates that the program is moving away from paper feasibility studies, laboratory work and infrastructure development which characterized prior years. We are now moving into the test of hardware, thus capitalizing on SDI investments.

MAJOR TECHNICAL ACCOMPLISHMENTS



jm-4356l / 050190

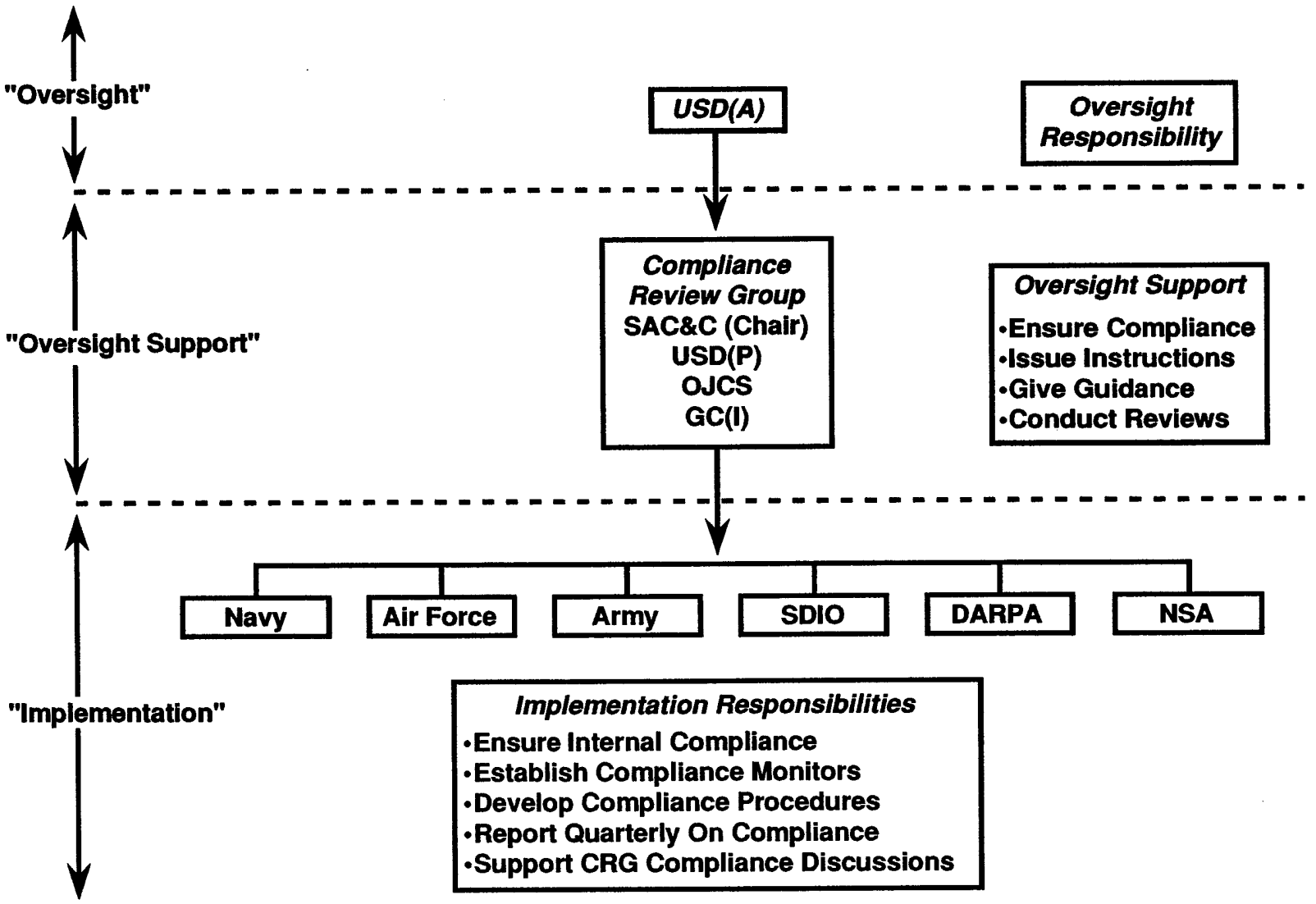
DoD COMPLIANCE PROCESS

- A process has been established to ensure that development and testing of SDS systems and components are in compliance with the ABM Treaty.

- The Antiballistic Missile (ABM) Treaty Compliancy Process involves review and oversight support of a DoD "Compliance Review Group," made up of four organizational units with the responsibilities of:
  - Conducting Reviews
  - Issuing Instructions
  - Giving Guidance
  - Ensuring Overall Compliance

- ABM Treaty compliancy checks are done internal to SDIO by the Office of the General Counsel. External to SDI and the DoD "Compliance Review Group," Congress as well as International Interests are involved in the process of ensuring compliancy to the ABM Treaty.

DoD COMPLIANCE PROCESS



jm-12185 / 110290

MINIATURE INERTIAL MEASUREMENT UNIT (IMU)

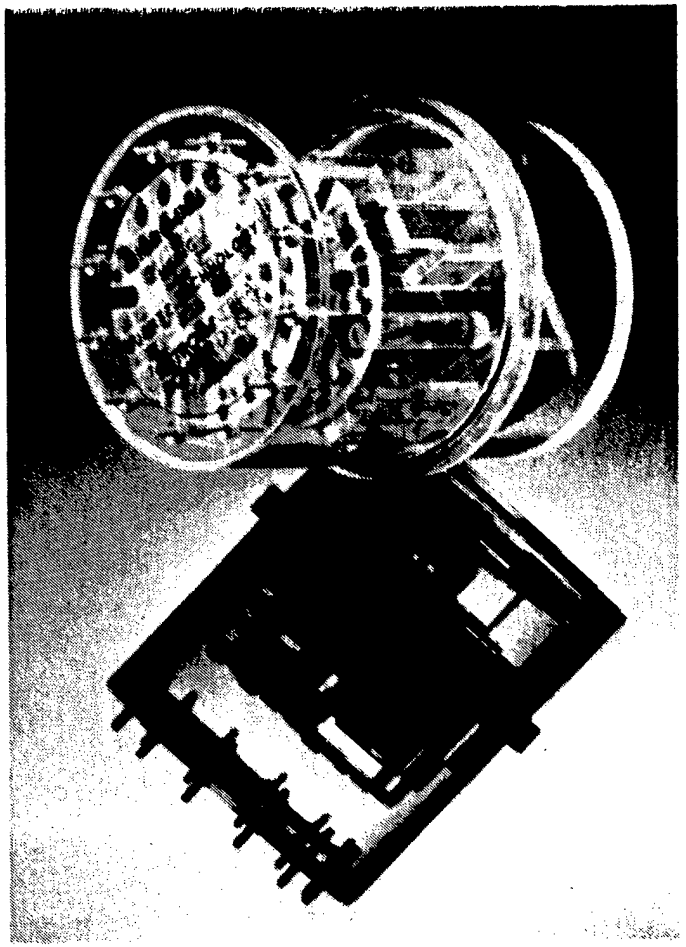
- Over the past 7 years, SDIO has invested in a wide range of technologies that have proven to have applications in other military arenas and in the commercial sector. The first example is the miniature Inertial Measurement Unit (IMU).

- Unit shown is a *Systron Donner* quartz IMU developed for SDIO
  - Since 1970's the IMU has advanced in many areas, such as;
    -- Developed from gimballed to micro-mechanical IMU operation
    -- Decreased in weight and size from a 40lb unit in 1970 to a unit < 1/2 oz in the 1990's
    -- Approximate cost per unit has decreased from $70,000 / unit to a current $500 / unit
    -- Quality grade has increased from a navigational to a tactical grade unit

- Other potential applications (future)
  - Civil
    -- Flight Test Instrumentation
    -- GPS Navigators
    -- Robotic Servo Control Systems
    -- Automated Manufacturing
    -- Aircraft Stabilization and Control Systems
    -- Active Suspension Systems (Automotive)
    -- Active Landing Gear Systems (Aircraft)
    -- Anti-skid Systems

MINIATURE INERTIAL MEASUREMENT UNIT (IMU)

- "MICRO IMU" DEVELOPED BY SDI FOR USE IN INTERCEPTORS:
  - UNDER EVALUATION FOR USE IN:
    - U.S. ARMY HELLFIRE MISSILE
    - U.S. ARMY NON-LINE-OF-SIGHT (NLOS) MISSILE
    - MULTINATIONAL MLRS TERMINALLY GUIDED WEAPON (TGW)
    - U.S. ARMY STABILIZED IR SEEKER (SURVIVES GUN LAUNCHED 10,000 G's)
    - U.S. ARMY TERMINALLY GUIDED SUBMUNITION
    - U.S. NAVY SHIPBOARD SATCOM STABILIZATION



900 0089
16 Feb 90

DIAMOND MATERIALS

- SDIO Diamond Technology Initiative started in 1986
  - Managed by Office of Naval Research for SDIO Innovative Science and Technology Office (IS&T)
  - Goal of initiative is nucleating (depositing or growing) single crystal diamond films on economical substrates

- Diamond offers the "best" and "most" in many categories of interest to the defense industry
  - Hardness
    - -- Creates use for diamond coated tooling
      - --- cutting tools
      - --- oil drilling bits
      - --- printed circuit drills
      - --- scalped blades
      - --- ball bearing coatings
  - Thermal conductivity
    - -- Creates use for semi conductor devices
      - --- very high power transistors
      - --- built-in jet engine sensor systems
      - --- radiation hardened silicon-on-insulator ICs
  - Corrosion resistance, radiation hard, non-toxic
  - Transmissivity across a broad spectral range
  - Epitaxial deposition (easy to deposit on irregular surfaces)
  - Electrical properties
    - -- Insulating when pure
    - -- Semi-conducting when doped
    - -- Faster than silicon or gallium arsenide
    - -- Can be etched into circuits

- Diamond may supplant silicon for use in fast, stable, heat tolerant circuits (32X better in overall semi-conductor performance than silicon)

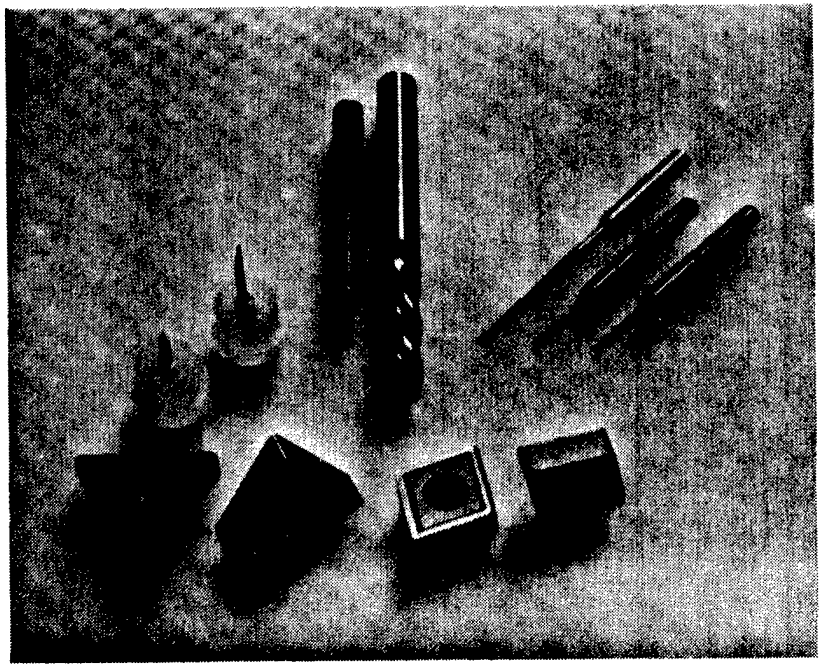
- Numerous other defense uses in materials, sensors / optics, electronics, survivability, etc.

- CRYSTALLUME making commercially available polycrystalline diamond films using the chemical vapor deposition process, and was (is) the only U.S. company to do so. Monocrystalline diamond development began in 1987.

- Funding for diamond technology is $10M / yr. Japan is currently spending more than ten times that amount for diamond coating.

DIAMOND MATERIALS

- SDIO: FIRST SPONSOR OF U.S. DIAMOND FILM RESEARCH AND DEVELOPMENT
  - SDIO SUPPORT RECOGNIZED IN BUSINESS WEEK MAGAZINE
- DIAMOND'S UNIQUE PROPERTIES HAVE MANY POTENTIAL APPLICATIONS TO A WIDE VARIETY OF PRODUCTS
  - POTENTIAL FOR $16 BILLION MARKET BY THE LATE 1990s
  - NUMEROUS APPLICATIONS TOOLING, ELECTRONICS, MATERIALS, etc.



COMPACT ACCELERATORS

- Linear accelerator technology originally intended for SDI directed energy applications and developed by the Los Alamos National Laboratory (LANL) has found many potential commercial applications. Originally a Soviet concept, proposed in 1970 that filled a three story room in its first versions, has been reduced by LANL to a table-top size accelerator. The Radio Frequency Quadrupole Linear Accelerator (RFQ LINAC) design from LANL was commercialized by AccSys Technology, Inc., Pleasanton, CA. Several applications have resulted.

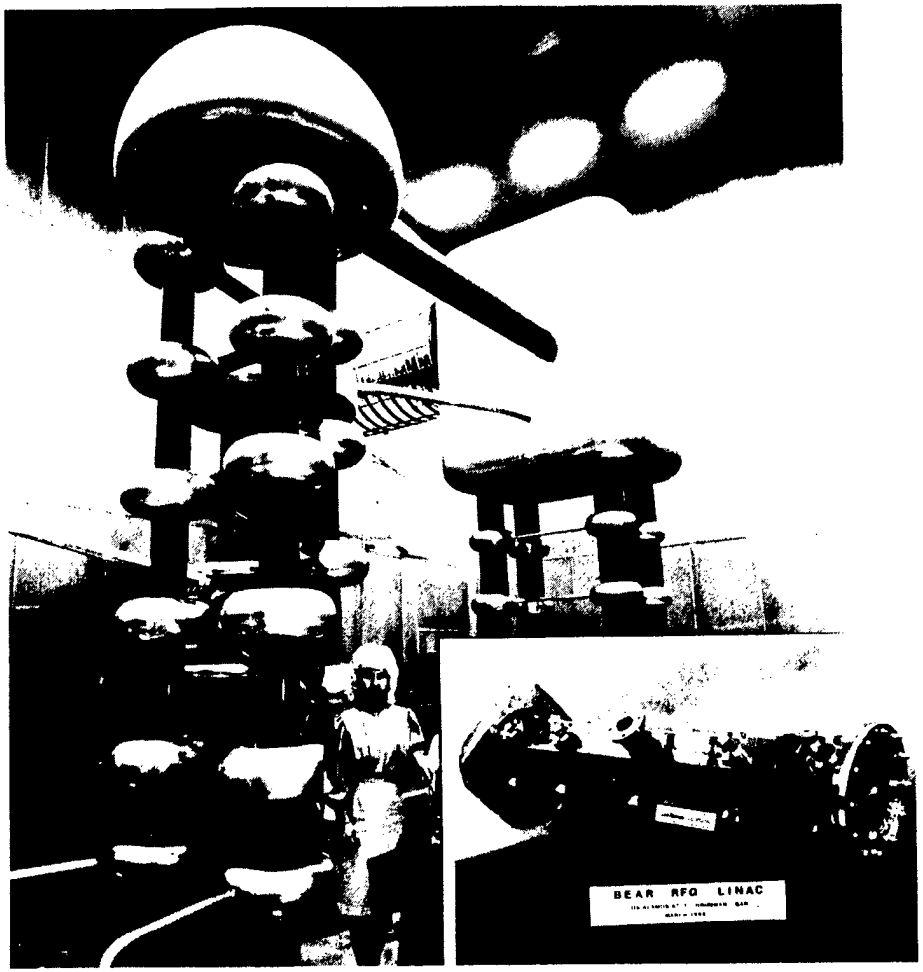
- *Medical Diagnostics*: The RFQ LINAC is being used to produce the radio pharmaceuticals used in Positron Emission Tomography (PET), a non-invasive medical imaging technology which produces false color images of the body's metabolic activity.
  - Few hospitals could afford to set up the facilities to produce the isotopes, or were too far from existing production facilities, severely limiting the powerful diagnostic promises of PET.
  - The compact RFQ LINAC from SDI research now makes it possible for more hospitals and research facilities to use PET in medical diagnosis.

- *Medical Treatment*: The Loma Linda University Medical Center in southern California has constructed a facility using the SDI developed RFQ LINAC for a proton therapy cancer treatment facility. Construction of the facility is complete and use of the LINAC in the clinical setting is expected early in 1990.

- *Explosive Detection*: AccSys Technology has sold an SDI derived RFQ LINAC to the FAA, who plan to develop a program using the device. Current explosive detection devices used at a few commercial airports use a proton generator to bombard potentially explosive materials.

COMPACT ACCELERATORS

- RADIO FREQUENCY QUADRUPOLE LINEAR ACCELERATOR (RFQ LINAC) CURRENT APPLICATIONS:
  - RADIO PHARMACEUTICAL PRODUCTION FOR POSITRON EMISSION TOMOGRAPHY (PET)
    - — RFQ ALLOWS WIDER USE OF THIS POWERFUL TECHNIQUE
  - CANCER THERAPY AND TREATMENT
    - — LOMA LINDA UNIVERSITY MEDICAL CENTER PROTON THERAPY UNIT
  - EXPLOSIVE DETECTION
    - — UNDER EVALUATION BY FAA



90U-0084
16 Feb 90

LEAP SEEKER TECHNOLOGY

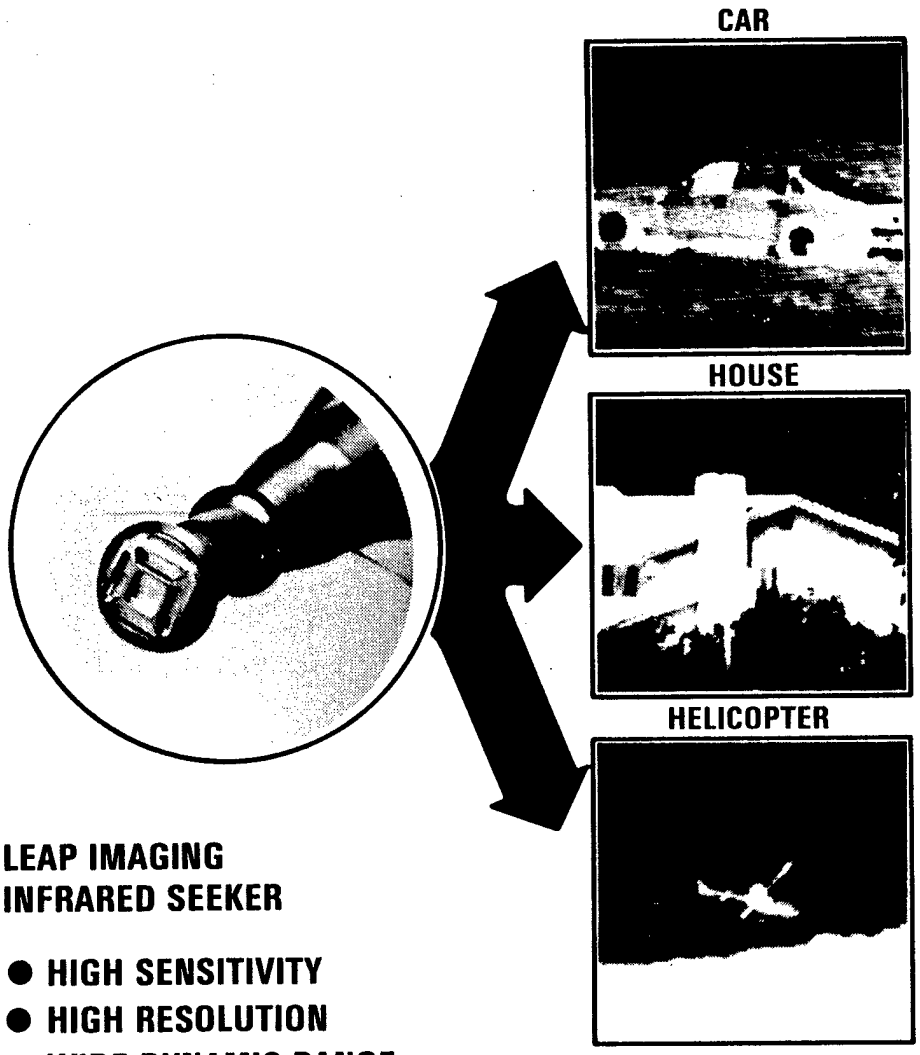
- The seeker shown contains an infrared sensor that is extremely lightweight and provides high sensitivity, high resolution, and wide dynamic range. This sensor was produced by Hughes for the Light Weight Advanced Technology Hit-to-kill Interceptor Program (LEAP).

- While this sensor is ideally suited to military applications, such as acquiring and tracking strategic and tactical targets, it has many non-military applications as well.

- The LEAP sensor provides a primary means of obtaining night vision through its' infrared seeking capability. This night vision could be used for law/drug enforcement activities, police search and rescue operations for detecting lost persons within wooded and waterborne areas, as well as fire detection for forest management.

- Sensor imaging could also be used in collision avoidance systems and autonomous vehicle guidance. Using a ranging device in combination with this sensor, a collision avoidance system could be developed. Specified recognition patterns could be mounted to allow autonomous vehicle guidance.

LEAP SEEKER TECHNOLOGY



LEAP IMAGING INFRARED SEEKER

- HIGH SENSITIVITY
- HIGH RESOLUTION
- WIDE DYNAMIC RANGE

POTENTIAL APPLICATIONS

- NIGHT VISION
  - — LAW/DRUG ENFORCEMENT
- SENSOR IMAGING
  - — AUTONOMOUS VEHICLE GUIDANCE
  - — COLLISION AVOIDANCE
- FOREST MANAGEMENT
  - — FIRE DETECTION

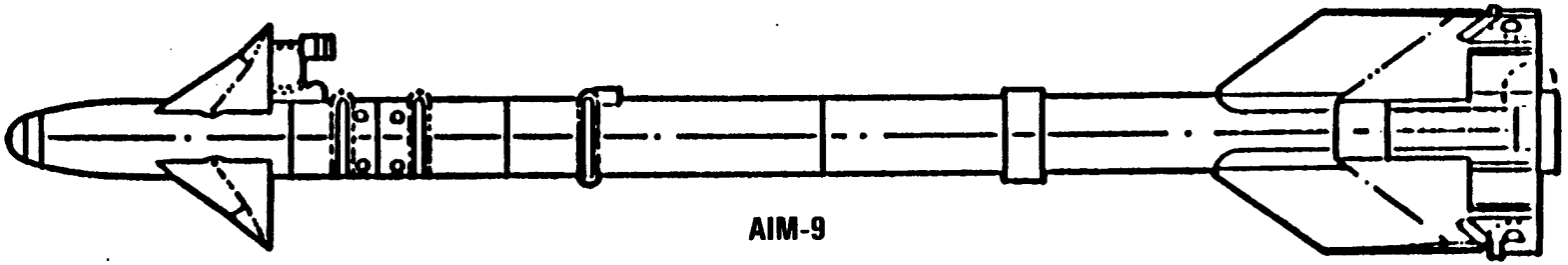
90U-0083
16 Feb 90

AVIONICS TECHNOLOGY SPINOFFS

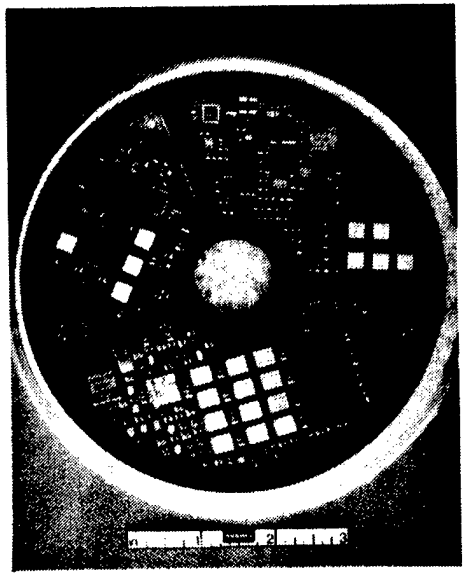
- The current AIM-9R imaging IR seeker has approximately 12 inches of 5-inch diameter cards for all of the avionics. About two inches of this is dedicated to the drive electronics for the actuators. The remaining 10 inches could be repackaged, using LEAP avionics technology (80386 processors and hybrid wafer scale integration), into about one inch. The weight savings associated with the repackaging would be a reduction from 16 pounds to one pound. Furthermore, a simple scaling down of propulsion for the lighter payload would result in an additional 20 pounds reduction.

- There are other potential technology changes which would further reduce the AIM-9 missile size, such as relying on tail control, hit-to-kill guidance, and an overall smaller diameter air frame (four inches). Hit-to-kill guidance is now possible using the algorithms and guidance and control systems developed for LEAP, HEDI, GBI, and SBI. The resulting AIM-9 would weigh as little as 100 pounds: a 43 percent reduction from the initial 176-pound AIM-9R.

AVIONICS TECHNOLOGY SPINOFFS



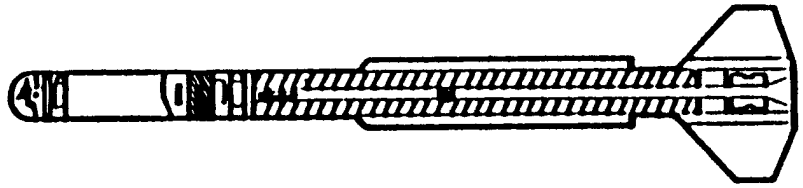
AIM-9



LEAP AVIONICS
(HYBRID WAFER SCALE INTEGRATION)

POTENTIAL FOR AIR-TO-AIR MISSILE

- 43% TOTAL WEIGHT REDUCTION
- 10 INCHES OF AVIONICS REDUCED TO 1 INCH
- 16 LBS OF AVIONICS REDUCED TO 1 LB
- REDUCTION IN PROPULSION REQUIRED
- REDUCED DIAMETER, HIT-TO-KILL, SMALLER TAIL CONTROL SURFACES



LASER TECHNOLOGY APPLICATION

- New applications of the pulsed CO_2 Laser in combination with a new imaging procedure in the treatment of burns

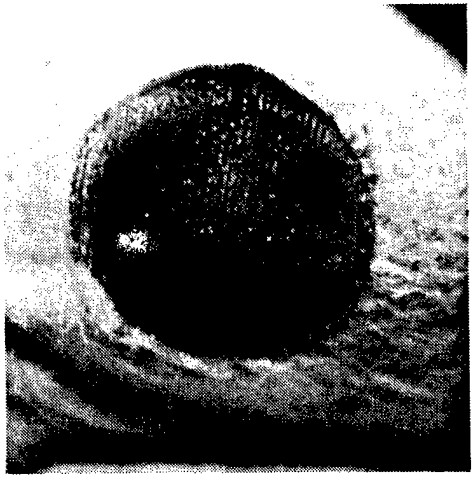
- The theory of surgical burn management is to identify the extent and the depth of the burn and subsequently debride the necrotic tissue as close to the viable tissue as possible. The viable or living tissue thereafter can sustain skin grafts. In large burns this is prohibitive, as the only way to identify living tissue is to use bleeding as an end point. In these large cases, too much blood is lost in the debriding process. As a result, many burn surgeons excise down to the next landmark which is the fascia over the muscle. This sacrifices too much normal tissue.

- Recent developments in the Wellman Laboratories utilizing the pulsed CO_2 laser may make it the ideal tool to debride burn eschar. By utilizing this new technology, large areas of dead skin may be ablated rapidly with great precision and accuracy of depth, due to the achievement of high peak power and short pulse intervals. Little residual thermal damage is produced by this procedure, so the ensuing bed remains viable and capable of sustaining a graft. Also due to the laser, hemostasis is achieved immediately.

- This laser modality is further aided by a new imaging technique, also developed in the Wellman Laboratories. This is a new method of assessing early and accurately the depth of the necrotic burn. The imaging technique utilizes a nontoxic intravascular dye (indocyanine green) which is excited by two wavelengths of infrared light. The image of the florescence of this dye can be utilized to identify which tissue needs laser excision and which tissue is living and able to sustain a graft.

LASER TECHNOLOGY APPLICATION

EXCISION BY SCALPEL



EXCISION BY LASER

PULSED CO_2 LASER WITH NEW IMAGING PROCEDURES APPLIED TO THE TREATMENT OF BURNS

- REPLACES SURGICAL METHODS REQUIRING MULTIPLE OPERATIONS
- LARGE AREAS OF DEAD SKIN ABLATED RAPIDLY WITH GREAT PRECISION AND ACCURACY
- REDUCED SCARRING
- PROVIDES EXCELLENT BASE FOR SKIN GRAFTS

90U-0086
16 Feb 90

GEL TECHNOLOGY SPINOFFS - CONTROLLED EJECTION

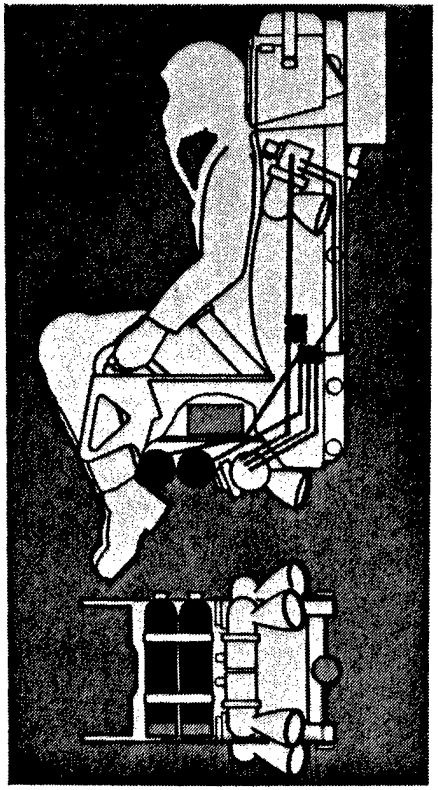
- Smart ejection seats would assist in preventing pilot death and injury during emergency ejection. A smart seat would consist of gyros, guidance processors, and a gel-based attitude control system for seat orientation and control. Gel propellants are better than the conventional solid propellants, since they can be pulsed and throttled for greater seat control.

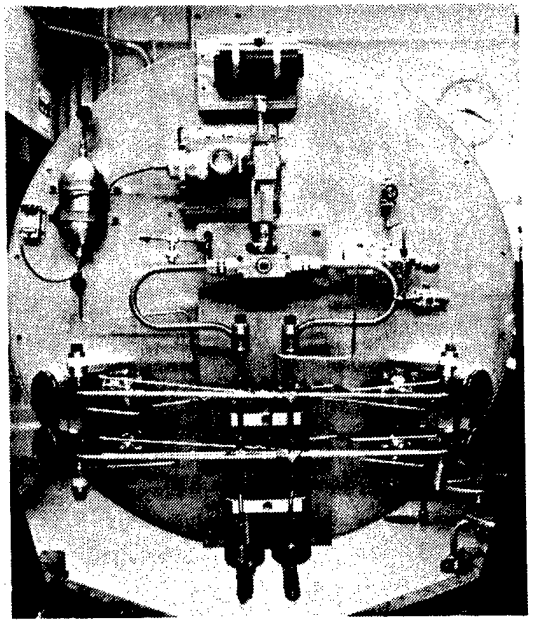
- The application of an advanced microprocessor with attitude gyros and throttable gel propellent fueled thrusters could provide increased capability for adverse ejection situations. At high speed the tremendous drag forces rapidly slow the seat down causing injuries. With controlled thrusters the seat can be slowed following a controlled profile. Studies show ejections at 800 kts and beyond could be within human tolerance levels. At low altitude the gyros sense position and provide controlled full power thrust to guide the seat into a horizontal position and fly it away from the ground. The microprocessor samples the gyros and commands the thrusters every 10 milliseconds.

- Tests were successfully completed on a brassboard ejection seat at TRW's Capistrano test site in April of 1989. Using scaled down 1500 lb gel engines, full thrust was obtained in 8 ms of burn time. Pulse duty cycles were demonstrated at 2, 4, 6, 8, and 10 ms pulse durations. A total of 247 pulses were completed in about 1.5 seconds of test time. This test was the first complete system test for gel propellants.

- The tests were conducted by McDonald Douglas at TRW under Army Missile Command direction.

GEL TECHNOLOGY SPINOFFS— CONTROLLED EJECTION





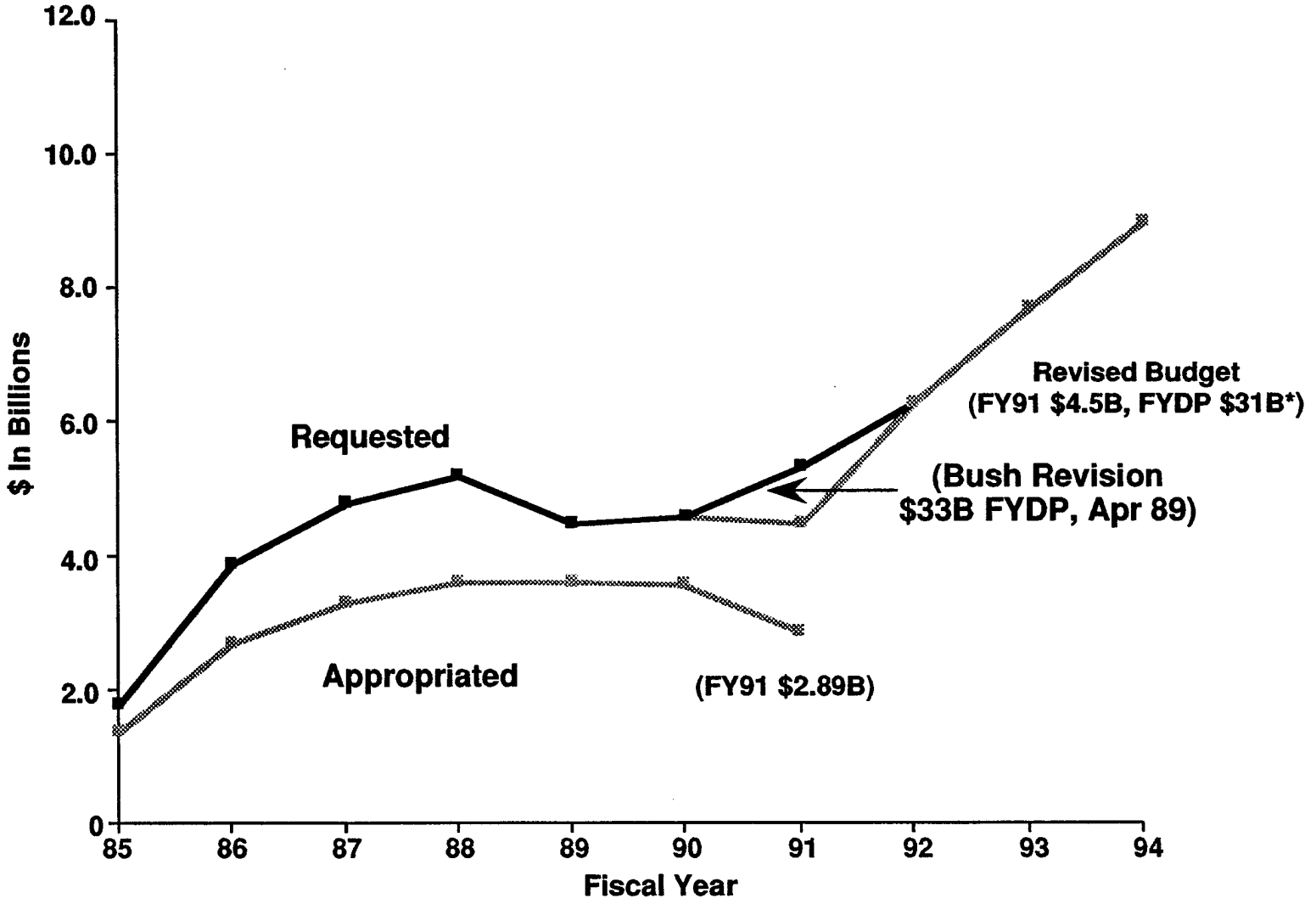
BRASSBOARD

- POTENTIAL FOR SMART EJECTION SEATS WITH APPLICATION OF PROCESSORS, GYROS AND GEL PROPELLANTS
  - — HIGH SPEED EJECTION MORE SURVIVABLE DUE TO CONTROLLED SLOW-DOWN USING THROTTLEABLE THRUSTERS
  - — AVOIDS TUMBLING
  - — CAPABILITY FOR LOW ALTITUDE/ ADVERSE POSITION EJECTION WITH CONTROLLABLE THRUST LEVELS AND DIRECTION
- FIRST COMPLETE SYSTEM TEST OF GELS (APRIL 1989)
  - — 2 MILLISECOND VALVE RESPONSE TIME
  - — FULL THRUST ACHIEVED IN 8 MILLISECONDS
  - — 247 THROTTLE PULSES IN 1.5 SECONDS

PROGRAM BUDGET

- The SDI program budget appropriated for FY 90 was $3.57B.
- The current request as shown for FY 91 was above the FY 90 mark at $4.5B with a Five Year Defense Plan (FYDP) $31B.
- The FY 91 SDI budget is $2.9B, a reduction of $1.6B from the President's request. The Out Year Defense Plan is currently being revised to reflect this change in funding.

PROGRAM BUDGET



* Excludes Subsequent $1B FYDP Escalation Adjustment

jm-5232d / 102490

FY 91 SDI BUDGET

- In addition to reducing the FY 91 SDI budget, Congress, in the FY 91 Defense Authorization Conference Bill, reoriented the SDI-related program elements (PE's) to reflect five functional mission areas and restricted funding within each PE.

- The five new funding categories are mission-oriented, as opposed to the functional and technical orientation of the old categories. This change may be worthwhile, as it places emphasis on products. The funding restrictions are another matter. Within 90 days of passage of the FY 1991 Appropriations Act, a report must be submitted to the Congress on the allocation of funds to the various SDI programs. This will show the specific "practical" impacts.

FY 91 SDI BUDGET *
($ M)

New Program Element (PE)	FY 91 Funding
Phase I Defenses	817.3
Limited Protection Systems	389.0
Theater And ATBM Defenses	180.0
Follow-on Systems	754.3
Research And Support Activities	749.4

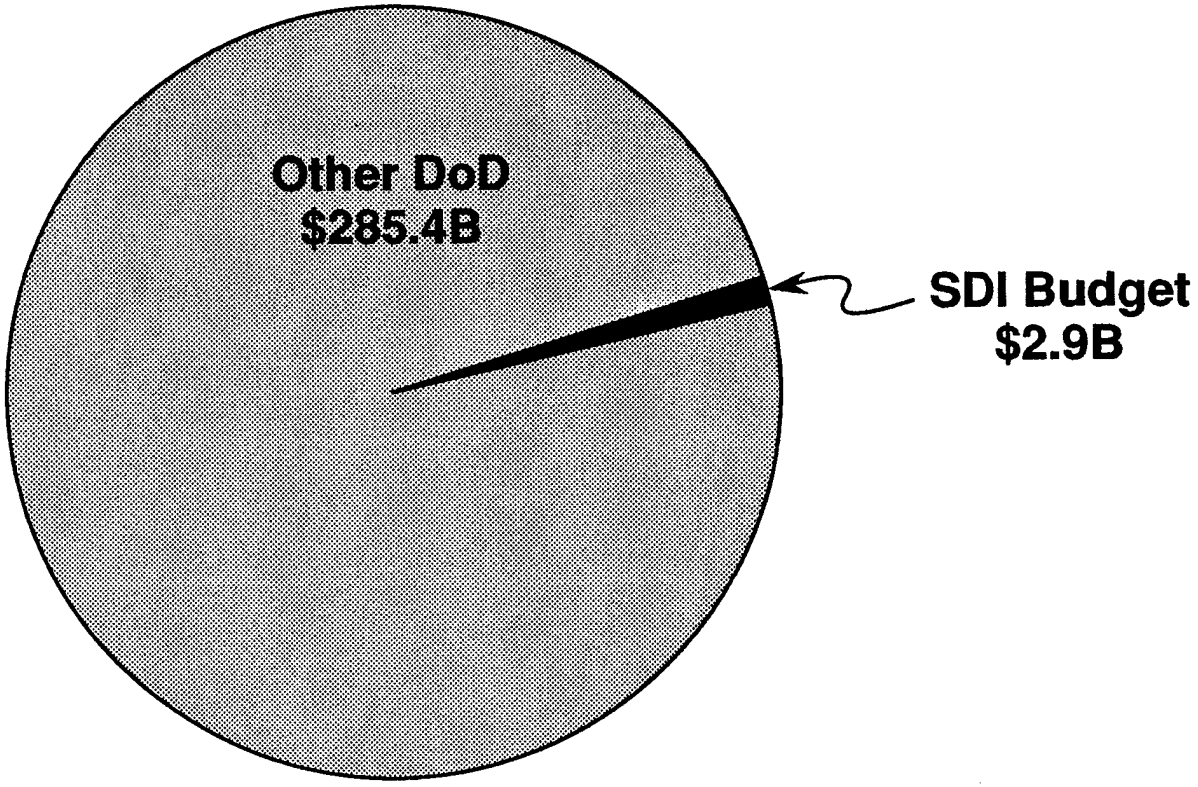
* Transfers Limited To 10% Of The Amount Provided For The PE From Which The Transfer Is Made

SDI AND THE DOD BUDGET

- A comparison of the SDI FY 1990 budget to the overall DoD budget shows that SDI represents only 1% of the total DoD budget.

SDI AND THE DoD BUDGET

FY 1991 DoD Budget $288.3B



SDI Represents 1% Of Total DoD Budget

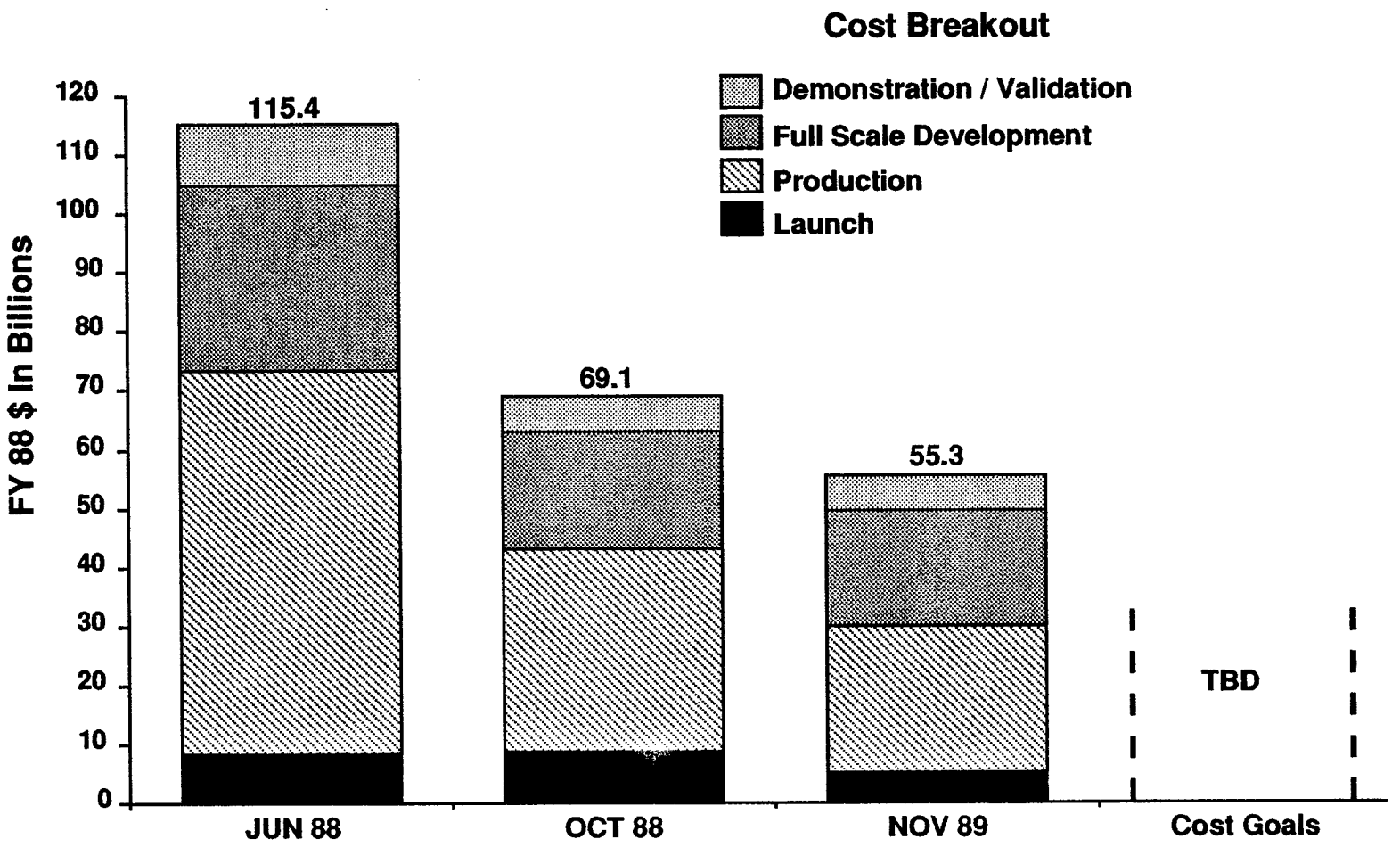
jm-11774 / 111990

SDS PHASE I COST REDUCTIONS

- In June 1988, at a DAB review, the direction of the SDI program was affirmed and the cost of a Phase I system was estimated to be $115 billion. Significant technology advancements in many areas of the SDIO program, coupled with results of previous system concept analyses, led to a cost estimate dramatically reduced to $69 billion. These results were affirmed in Oct 1988. Since then, continued technical progress and an evolving architecture for the space-based portion of Phase I have reduced the cost figures further to $55 billion (in constant FY88 dollars).

- Potential cost reductions are most significant for the Space-based Interceptor element. The architecture outlined for the DAB in 1988 called for SBIs to be housed in several hundred Carrier Vehicles (CVs). Each CV would contain a magazine of SBIs that would orbit the earth, ready on command to attack ICBM boosters and post-boost vehicles. While that approach can meet military requirements, and rigorous testing such as the ONTARGET series confirms the technology, a study was undertaken during the summer of 1988 to find ways to reduce the cost further and increase the effectiveness and survivability of the space-based element of the system. This study examined many different space-based architectures and identified one -- the Brilliant Pebbles (BP) approach -- as a promising concept to achieve the objectives for a SDS and one that may lower Phase I costs while maintaining the level of effectiveness established by the Joint Chiefs of Staff for a SDS.

SDS PHASE I COST REDUCTIONS



jm-4352B / 072490

SUMMARY

- As you have seen today, the SDI continues as a deterrent force against Soviet as well as Third World Ballistic Missile Proliferation.

- The technology is at hand to develop a Strategic Defense System capable of deployment, and as an organization we continue to work as a team to that end.

- In addition, SDI is affordable.

SUMMARY

- Technology Is At Hand To Develop And Deploy A Strategic Defense System
  - Engineering Task Is Challenging -- Military, Civilian And Allied Participants Continue To Work As A Team
  - Supported By Many Independent Evaluations By The Scientific Community

- Planned Phase I And Evolving Architectures
  - Meet JCS Requirements
  - Research Strives To Ensure Viable Future Options For Requirements Beyond Phase I
  - Take Advantage Of Continued Cost Reduction Efforts

- Developing SDI Technologies Have Ever Broadening Military, Civilian And Commercial Applications
  - Medicine
  - Science
  - Engineering

- Strategic Defense Is Both Necessary And Affordable. As The SDI Program Progresses Costs Continue To Be Reduced

BACK-UP

SDIO CHARTER: FUNCTIONS

- SDIO Functions
  - Develop Programmatic Policies
  - Issue Program Guidance
  - Assign DoD Component Responsibilities
  - Develop Systems, Standards, And Procedures For Management And Support Of Approved SDI Plans And Programs
  - Establish Prioritized Program Goals And Objectives
  - Evaluate DoD Component SDI Program Activities

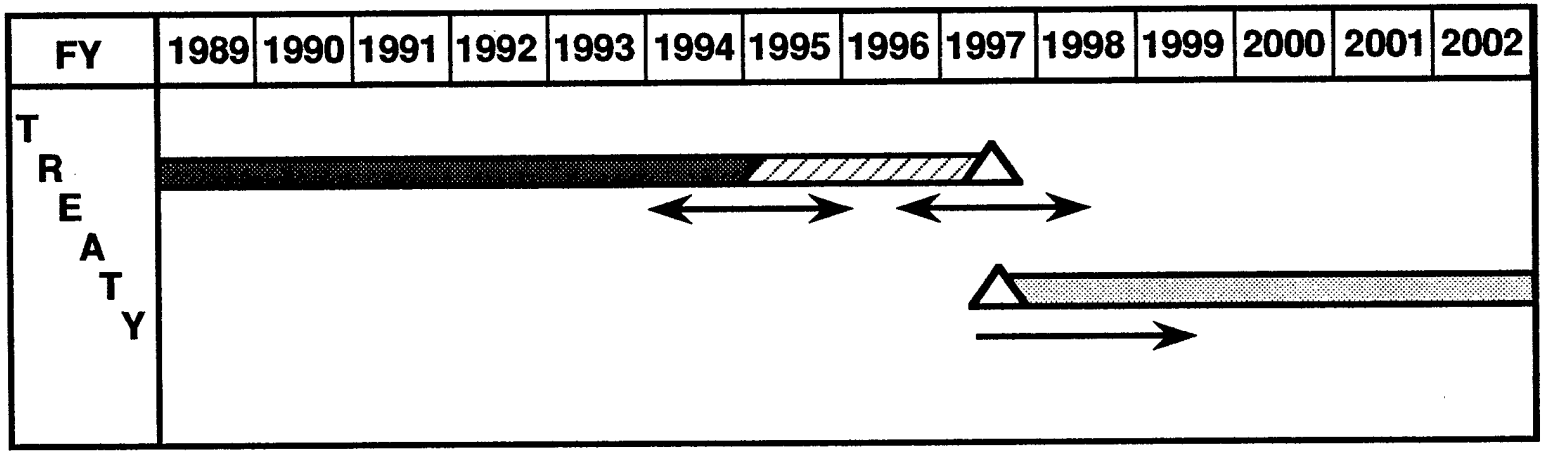
CHARACTERISTICS OF THE EMERGING SECURITY ENVIRONMENT

- Changes In The International Security Environment
  - Increased Regional Instability And Conflict
  - Reduced U.S. Overseas Presence
  - Extensive U.S. Interests On A Global Scale
  - Short-range Nuclear Forces Reduced / Eliminated In Europe
- Increased Proliferation Of Advanced Military Technology
  - Ballistic Missiles
  - Chemical, Biological And / Or Nuclear Weapons
  - Space-based Reconnaissance And Surveillance
- Mutual U.S.-Soviet Concern For Ballistic Missile Proliferation
  - Potential For Improved U.S. - Soviet Relations

THE U.S. ROLE IN THE EMERGING INTERNATIONAL ENVIRONMENT

- International System Moves From Bipolarity To Multipolarity
  - Increased Risk Of Regional Conflict
  - U.S. Moves Toward Military Disengagement
    - Increased Requirement For U.S. Power Projection Capabilities
  - U.S. Participation In Alliances / Collective Defense Agreements Will Require Credible Long Distance Support For Commitments

ABM TREATY CONSTRAINTS



Legend

- Deployment
- Testing — Can Accommodate Narrow Interpretation
- Testing — May Request Testing Under Broad Interpretation
- Deployment — Exceeds Treaty Limits

jm-2844C / 021690

NATIONAL SECURITY POLICY MUST BE DEVELOPED IN THE CONTEXT OF EMERGING THIRD PARTY MILITARY CAPABILITIES

- Regional Powers Are Acquiring A Range Of Advanced Military Technologies
  - Nuclear, Biological, Chemical Weapons
  - Ballistic Missiles
  - Space Launch Capabilities And Satellites
- These Technologies Are Available From A Variety Of Sources
  - Sale By Industrialized States
  - Modification With Foreign Expertise
  - Indigenous Production Of Subsystems, Systems
- Proliferation Is Occurring In Politically Unstable Regions
  - Middle East
  - South Asia
  - East Asia

THIRD PARTY BALLISTIC MISSILES MAY BE ARMED WITH MASS DESTRUCTION WARHEADS

- Conventional High Explosive
  - Used Extensively During Iran-Iraq War
  - Primarily A Terror Weapon Against Urban Populations

- Advanced Conventional Munitions (Submunitions, Fuel-Air Explosives)
  - Enhanced Lethality Against A Range Of Military Targets
  - Significant Interest In Development

- Chemical (Mustard, Nerve Gas) And Biological (Anthrax, Plague) Weapons
  - Technology To Develop Chemical Weapons Widespread
  - Effects Highly Dependent Upon Local Conditions

- Nuclear Weapons
  - Devastating Across Range Of Possible Targets
  - States With Most Active Nuclear Programs Also Possess Substantial Missile Programs

NEW TECHNOLOGIES PROVIDE REGIONAL POWERS WITH A RANGE OF CAPABILITIES

- To Date, Ballistic Missiles In The Developing World Have Been Used For Their Military Effectiveness
  - Speed
  - Penetrativity
  - Low Warning Time

- Combined With Other Military Forces, Ballistic Missiles Offer Potential To Deter U.S. Ability To Protect Vital Interest
  - Coerce Neighbors, Including U.S. Friends And Allies
  - Raise Price Of Intervention
  - Hold U.S., Allied Forces At Risk

- Ultimately, Third Party Military Capabilities May Be Translated Into Increased Geopolitical Influence
  - Expand Regional Influence
  - Eclipse Outside Powers
  - Increase Control Over Regional Environment

THIRD PARTY BALLISTIC MISSILES COULD POSE A RANGE OF THREATS TO U.S. INTERESTS

- Third Party Ballistic Missiles Pose A Direct Threat To:
  - U.S. Forces, Facilities Abroad
  - Friends And Allies
  - Power Projection Forces
- Possession Will Increase Ability To Escalate Regional Conflicts
  - Scope
  - Intensity
- Potential Future Threats Against Continental United States

ACTIVE DEFENSE IS AN ATTRACTIVE RESPONSE TO BALLISTIC MISSILE PROLIFERATION

- **Arms Control**
  - Technology Transfer Limitations Highest Leverage Against Least Advanced States
  - Declining Efficacy As Capabilities, Technologies Spread
- **Deterrence / Retaliation**
  - Differing Value Systems; Concepts Of Deterrence Uncertain
  - Existence Of Regional Arsenals Could Deter U.S. Freedom Of Action
- **Pre-emption**
  - Unlikely To Be Politically Acceptable
  - Likely To Be Militarily Difficult
- **Defense**
  - Negate Military Effects Of Missiles, Warheads
  - Allow U.S., Allies To Pursue Interests

"The Element Which Is Tending To Rapidly Enhance The Strategic Value Of Ballistic Missiles...Is That There Is Yet No Credible Defense Against Them."

Air Commodore Jasjit Singh, "The Strategic Deterrent Option," Strategic Analysis, September 1989

THE CONTRIBUTION OF STRATEGIC DEFENSES TO MEETING THIRD PARTY MISSILE THREATS

- Space-based Sensors
  - Global Launch Detection, Tactical Warning And Attack Assessment
  - Monitoring Of Third Party Missile Tests, Space Launches
- Brilliant Pebbles
  - Global Presence
  - Able To Intercept Longer-range Missiles
- Theater Defenses - PAC-2, Arrow, THAAD, ERINT
  - Able To Intercept Shorter-range Missiles
  - Need To Link To Space-based Sensors

PROLIFERATION

- The Proliferation Of Advanced Military Technology Is Occurring In Developing Areas
  - Middle East
  - South Asia
  - East Asia

- Proliferation Involves A Range Of Advanced Military Technology
  - Nuclear, Chemical, Biological Weapons
  - Ballistic Missiles
  - Space Launch Capabilities And Satellites

- Third Party Ballistic Missiles Pose A Direct Threat To
  - Regional Stability
  - U.S. Forces, Facilities Abroad
  - U.S. Friends And Allies
  - U.S. Power Projection Forces

PROLIFERATION (Cont'd)

If Uncountered Will:

- **Broaden The Geographic Scope Of Regional Conflicts**
- **Destabilize Regional Relationships: Threaten Regional Economic / Political Development**
- **Threaten U.S. Allies And Forces Abroad, Eventually Threatening U.S. Homeland Itself**
  - **Degrade Credibility Of U.S. Commitment To Defense Of Allies**
  - **Increase Political, Military Cost Of Peacekeeping And Power Projection Abroad**
  - **Deter U.S. Power Projection And Participation In International Peacekeeping Activities**
  - **Render U.S. Vulnerable To Irrational, Undeterrable States Armed With Missiles And Nuclear, Chemical, Or Biological Warheads**
- **Increase Likelihood Of Accidental / Unauthorized Launch**

THIRD WORLD BALLISTIC MISSILE PROGRAMS

Afghanistan			
	Scud B	300 km	In Service
Argentina			
	Condor II	1000 km	?
Brazil			
	SS-300	300 km	In Dev't
	SS-1000	1200 km	In Dev't
Egypt			
	Scud B	300 km	In Dev't / Production
India			
	Prithvi	150 km	Testing
	Agni	2500 km	Testing
Iran			
	Scud B	300 km	In Service
	Shahin 2	130 km	In Service
Iraq			
	Scud B	300 km	In Service
	Al-Hussein	650 km	In Service
	Al-Abbas	900 km	In Service
	Tammuz 1	2000 km	Testing
Israel			
	Jericho I	500 km	In Service
	Jericho II	1500 km	In Service
Libya			
	Scud B	300 km	In Service
N. Korea			
	Scud B	300 km	In Dev't / Production
Pakistan			
	Hatf I	80 km	Testing
	Hatf II	300 km	Testing
Saudi Arabia			
	CSS-2	2700 km	In Service
South Africa			
	Jericho II	1500 km	Testing
South Korea			
	Nike Hercules	100 km	In Service
Syria			
	Scud B	300 km	In Service
	SS-21	110 km	In Service
Yemen			
	Scud B	300 km	In Service

Source: Department of Defense

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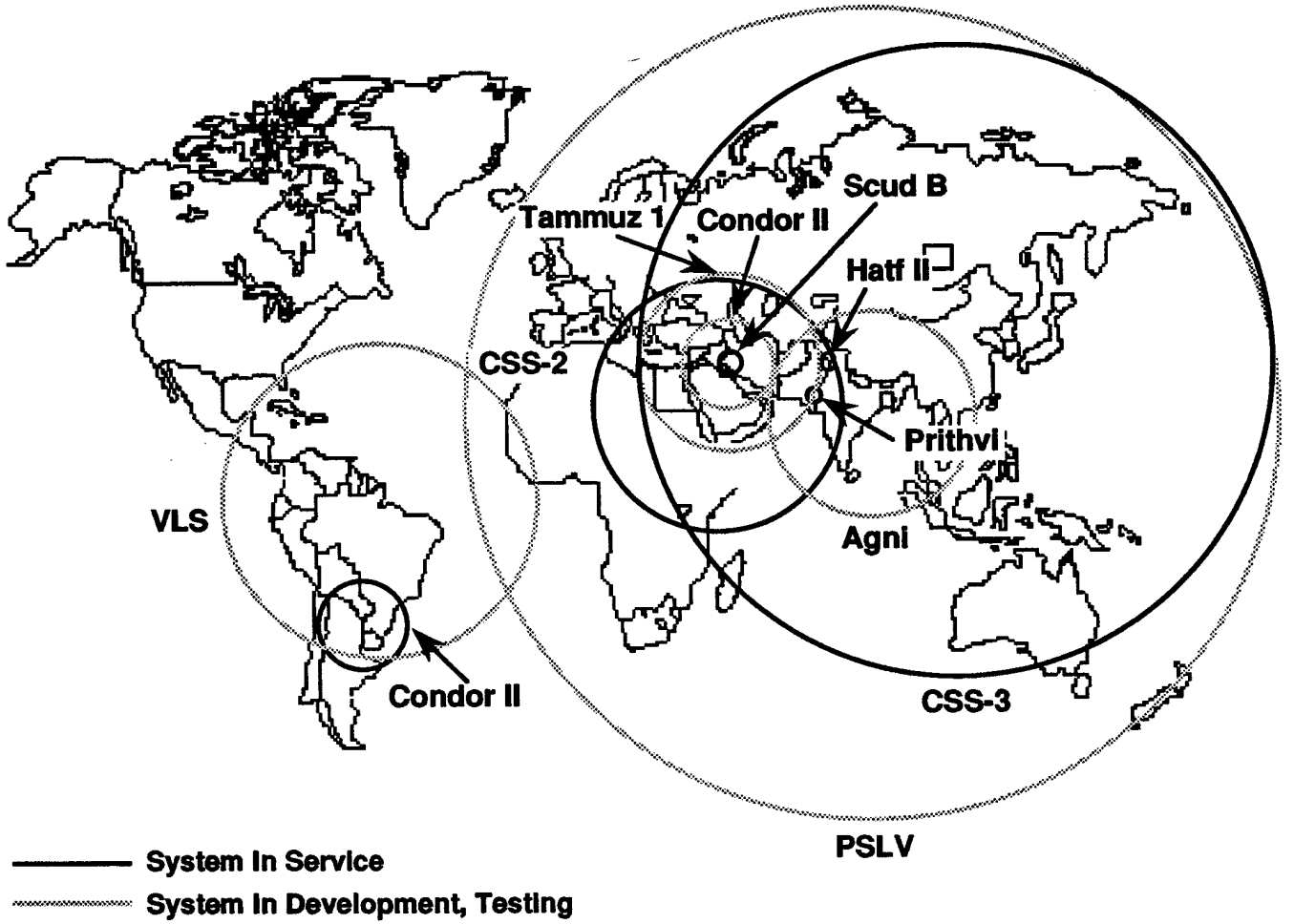
THE EMERGING BALLISTIC MISSILE PROBLEM



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REGIONS OF POTENTIAL INSTABILITY / CONFLICT

Marked Countries: **South Africa, Namibia, Angola, Libya, Egypt, Chad, Saudi Arabia, Yemen, Oman, North Arab Emirates, Iraq, Iran, Yugoslavia, Qatar, Kuwait, Jordan, Turkey, Syria, Cyprus, Romania, Hungary, Bulgaria, Afghanistan, Pakistan, India, Sri Lanka, Kathmandu, Bhutan, Bangladesh, Vietnam, Cambodia, North Korea, South Korea, Indonesia**

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EVOLVING BALLISTIC MISSILE CAPABILITIES

Marked Countries: **Afghanistan, Argentina, Brazil, Egypt, India, Iran, Iraq, Israel, Libya, North Korea, South Korea, Pakistan, Saudi Arbia, South Africa, Syria, Yemen, Taiwan**

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THE THREAT POSED BY PROLIFERATION

"Our Missiles Cannot Reach Washington. If They Could Reach Washington, We Would Strike It If The Need Arose."

Saddam Hussein

"Did Not The Americans [In The Air Strikes On Tripoli And Benghazi] Almost Hit You...If They Know That you Have A Deterrent Force Capable Of Hitting The United States, They Would Not Be Able To Hit You. If We Had Possessed A Deterrent--Missiles That Could Reach New York--We Would Have Hit It At The Same Moment. Consequently, We Should Build This Force So That They And Others Will No Longer Think About An Attack."

Col. Qadhafi

Hussein Quote Taken From A Report Of A Closed Meeting With Palestinian Leadership In Baghdad In Al-Muharrir, 8 May 1990, p. 3. Translated By Foreign Broadcast Information Service In FBIS-NES-90-090-A, p.3. FOR OFFICIAL USE ONLY

Quadafi Quote Taken From Speech At A Meeting With Students Of The Higher Institute For Applied Social Studies At The Great al-Faith University, April 18, 1990, Tripoli Television Service, April 19, 1990 (Translated In Foreign Broadcast Information Service, Daily Report; Near East & South Asia, FBIS-NES-90-078, April 23, 1990, p. 8)

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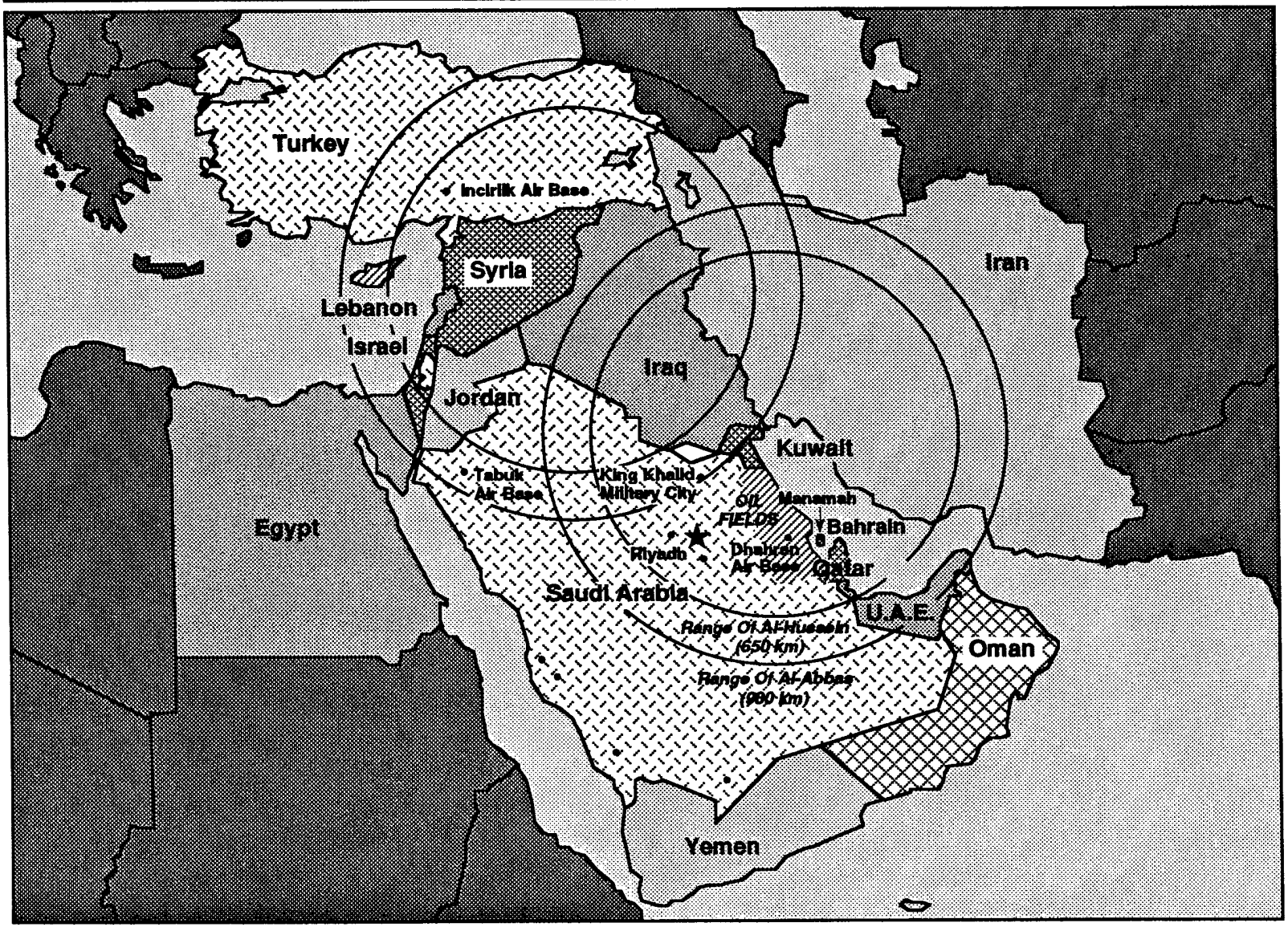
IRAQ'S MISSILE FORCES POSE A DIRECT THREAT TO VITAL ASSETS IN SAUDI ARABIA



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SOVIET INTEREST IN COOPERATIVE DEFENSE DEPLOYMENT

- Some Soviet Political And Military Officials Have Endorsed Mutual Deployment Of Defenses
  - Logically Would Be Compatible With Historical Soviet Interest And Commitment To Limiting Wartime Damage
  - "Sensors Go Free," Space-based
  - 200 And 1,000 Interceptors Cited As Associated With Proliferation Threat
  - Revision Of The ABM Treaty Endorsed
- The Expressed Soviet Rationale For Mutual BMD
  - Concern About Third Party Ballistic Missiles
  - Technical And Political Viability Of SDI
  - Preference For A Defensive Strategy

SOVIET INTEREST IN MUTUAL DEFENSES

"Nor Must We Disregard The Fact That Many Countries Are Standing On The Threshold Of Mastery Of Nuclear And Missile Technology...

In These Conditions The Soviet Union And The United States Will Possibly Have To Jointly Seek Ways To Defend Their Territories From Probable Nuclear Missile Attack By Third Countries. However One Provision That Remains Fundamental Is The Nonsiting In Space Of Strike Weapons, Which Could Seriously Destabilize The International Situation"

Lieutenant General M. Vinogradov,
Major General V. Belous

Taken From "What The Generals Think About Disarmament: The Strategic Offensive Arms Treaty And Our Security." Sovetskaya Rossiya, 23 AUG 90, Second Ed. P.3, Translated By Foreign Broadcast Information Service In FBIS-SOV-90-165, 24 AUG 90, P.1

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SOVIET INTEREST IN COOPERATIVE TRANSITION

"A Similar [Cooperative] Decision Is Also Possible In The Sphere Of Space-based ABM Defense Positions, Whose Capabilities In A Global Conflict Are Being Questioned In Both The USSR And The United States. But What If The Conflict Is Not Global? What If We Are Talking About Guarantees Against Accidental Launches Or, Above All, Missile Launches By Extremist Groups? Such A Limited System Including Ground- And Space-based Positions For Combating Non-Massed Missile Launches Is Within The Bounds Of Feasible Technical Solutions"

Professor V. Etkin,
Chief Of Applied Space Physics
At The Institute Of Space Research
Soviet Academy Of Sciences

V. Etkin. "From Secrecy To Trust." Pravda 20 JUL 89, P.5

CONCLUSIONS

- **Ballistic Missile Technology Is Spreading Globally**

- **Arms Control And Diplomacy Have Been Unable To Stem The Spread And Use Of Such Technology**

- **Ballistic Missile Defense Provides Attractive Option To Negate Third Party Ballistic Missile Capabilities**

  - **Defend U.S. Forces, Allies, Homeland**

  - **Allow U.S. To Protect Vital Interests Without Interference**

  - **Ensure Continued U.S. Ability To Influence Regional Events**

CONCLUSIONS (Cont'd)

- The International System Increasingly Is Multipolar
- Regional Instabilities Will Increase With Multipolarity
- U.S. Disengagement Will Compel It To Rely More On Power Projection Capabilities To Protect Its Global Interests And Allies
- Proliferation Is Occurring Rapidly In Critical And Unstable Areas
- Proliferation Will Threaten The U.S. Will And Capability For Power Projection, And Eventually The U.S. Itself
- Soviet Officials Recognize The Proliferation Threat; Some Endorse U.S.-Soviet BMD Efforts And Revision Of The ABM Treaty As A Response